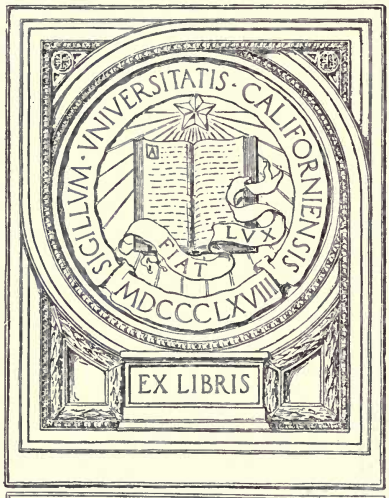
4:25

THE GIFT OF
FLORENCE V. V. DICKEY
TO THE
UNIVERSITY OF CALIFORNIA
AT LOS ANGELES



THE DONALD R. DICKEY
LIBRARY
OF VERTEBRATE ZOÖLOGY

THE MAMMALS

OF

PENNSYLVANIA AND NEW JERSEY.

A BIOGRAPHIC, HISTORIC AND DESCRIPTIVE ACCOUNT

OF THE

FURRED ANIMALS OF LAND AND SEA, BOTH LIVING AND EXTINCT, KNOWN TO HAVE EXISTED IN THESE STATES.

DESIGNED AS BOTH A POPULAR AND SCIENTIFIC PRESENTATION OF A BRANCH OF NATURE-STUDY HITHERTO UNDULY NEGLECTED.

BY

SAMUEL N. RHOADS.

"*Who teacheth us more than the beasts of the earth?*"—JOB xxxv, 11.

ILLUSTRATED WITH PLATES AND A FAUNAL MAP.

PHILADELPHIA.
PRIVATELY PUBLISHED.
1903.

COPYRIGHTED, 1903,
BY
SAMUEL N. RHOADS.

THE WICKERSHAM PRINTING CO.,
LANCASTER, PA.

R 34m

QL
719
P3
R346m
1903

MAMMALS OF PENNSYLVANIA AND NEW JERSEY.

BY SAMUEL N. RHOADS.

INTRODUCTION.

JOB, the ancient divine and naturalist, asks, "Who teacheth us more than the beasts of the earth or maketh us wiser than the fowls of heaven?" Owing to the difficulty of making acquaintance with those "beasts of the earth" which we call *Mammals*, because of their nocturnal, subterranean or aquatic habits, the study of mammalogy has never been as popular as that of the "fowls of heaven." It is, however, no less an interesting and profitable study and even yet furnishes the investigator, in spite of the great activity of the past decade in that branch, a far richer field for original zoölogical study than does ornithology. To man, himself a mammal, the importance of this study, especially as regards his physical, mental and spiritual relationships to the beasts of the earth, cannot, perhaps, be overestimated.

One of the most noticeable developments in biological research at the present day is along the line of geographic distribution. It has resulted in the solution of many vexed problems which the last century biologist vainly pondered. In the prosecution of this line of research much is discovered of an incidental character relating to the life-history of created things which has hitherto been hidden away. These are some of the facts which induced me, eleven years ago, to begin the work which forms the subject of this paper. In these studies I have been aided to a limited extent by the all-too-meagre and often misleading faunal publications of previous authors. More substantial and valuable aid has been received by means of voluminous correspondence and personal interviews with naturalists, trappers, hunters, old pioneers and frontiersmen living in the regions named. The main source of information, however, has been personal field experience in nearly every county in the two states. The collections of Pennsylvania and New Jersey mammals, resulting from this work, and numbering about 2,000 specimens, have recently been acquired by the Academy of Natural Sciences of Philadelphia. For the use of the unrivalled literary and museum facilities of this institution and the continued courtesy of its officers I am glad to have this opportunity to express my thankfulness.

550777

B 4883

The scope of the work now completed, may be thus defined. It treats of both living and extinct, recent and fossil, land and sea mammals found in Pennsylvania and New Jersey in the feral state. It includes not only those indigenous or native to the region but also those which have been introduced there either from native or foreign regions, whether by man's direct importation or by voluntary migration due to faunal and floral changes wrought by the deforesting and settling of the country since the beginnings of colonial history. After giving each native species and sub-species its most approved popular and scientific nomenclature with double literary references for the student, the "*Type locality*," "*Faunal distribution*," "*Distribution in Pennsylvania and New Jersey*," "*Records*" in the two states, "*Habits and economic status*," "*Historic references*," "*Description of species*," and enumeration of "*Specimen sexamined*," are also given more or less fully as each requires.

The fossil species are more briefly considered and in a separate division. Reference has already been made to the importance of the study of faunal distribution. A map of the two states, giving the limitations of the Lower Canadian, Transition and Upper Austral life-zones represented in their limits, has been prepared and the distribution of each species given in the text is stated in terms of these. The results of my observations enable me to define these with greater exactness than was heretofore possible, and to alter, in some degree, the complexion of the zoögeographic map heretofore used as a standard by students. As near as possible this is made to conform to our knowledge of primeval conditions, a standard now difficult to reproduce, owing to the vital biological changes which have resulted solely from the deforestation of our country. Fire, axe, flood, summer sun and winter frost have made the famous hunting grounds and natural game preserves of the Pennsylvania Alleghanies a wilderness indeed. Where once the Canada Lynx, Wolverene, Fisher, Marten, Canada Deer-Mouse, Woodland Jumping Mouse, Northern Hare, and Marsh Shrew found a congenial home, the average mid-summer temperature may now be roughly said to have risen 20 degrees, drought and flood quickly succeed each other, winds become tempests and winter takes on an Arctic severity. Instead of white pines and hemlocks we have scrub oaks and briars; instead of fern beds, sphagnum and moist shade we find bare rocks, glaring sun, and withered vegetation. The grinning opossum sneaks up the south slope as the last snowshoe hare hops down the northern one, and the lowland cotton-tail forthwith jumps her ancestral claim. While the rifle and the trap remained their greatest enemies, the beasts of the earth and the fowls of heaven had an even chance, but the era of axe and fire and commercialism has doomed them, unless the era of forestry soon rescues them from extinction.

To explain more fully the use and intent of the accompanying map of the

faunæ or life-zones of Pennsylvania and New Jersey, I will quote G. S. Miller, Jr.'s, lucid remarks thereon, given in his "Preliminary List of the Mammals of New York," "The importance of an acquaintance with the life-areas of a region, as a key to the geographic distribution of the animals and plants, is hardly to be over-estimated. Such knowledge furnishes ready and exact means of defining the ranges of species without the tedious enumeration of isolated localities, and offers moreover an explanation of the principal factor governing those associations of species that constitute local faunæ and floræ. Briefly defined, a *life-zone* is a trans-continental area bounded by certain isothermal (average temperature) lines, and characterized by relative uniformity of fauna and flora. Together with the isotherms a life-zone normally extends in an approximately east and west direction, but both are subject to endless deviations. Elevations in the surface of the earth cause the life-zones to bend to the southward, often many hundreds of miles beyond their sea level position. Furthermore, a life-zone is not necessarily continuous. It often happens that isolated hills or mountains reach a sufficient height to have about their summits the climatic conditions characteristic of a more northerly zone than at their bases. Effects similar to those of elevation are produced by isolated swamps and cold rock slides."

Illustrative of these remarks we find on looking at the map of Pennsylvania that the higher Alleghanian chain bearing the Canadian fauna on its crest, cuts the eastern and western extension of the transition zone in half, while the valley of the upper eastern branch of the Susquehanna brings about a reversal of these conditions by bisecting the Canadian zone with an offset of the Transition. In Fayette and Somerset Counties a most striking alternation of Austral, Canadian and Transition zones occurs as we travel along the Maryland line, due to the intrusive parallel range of the Alleghany ridge, Laurel ridge, and Chestnut ridge, with their intervening valleys. In the upper Austral zone of south New Jersey the "boreal" or transition islands of cool, dense-shaded cedar swamp and bog are a striking illustration of local conditions, and a like instance is the typical Canadian fauna of certain tamarack and fir swamps set in the midst of otherwise doubtfully Canadian regions in the northern part of both states.

In North America seven life zones are represented. These are (beginning at the north) the Arctic, Hudsonian, Canadian, Transition, Upper Austral, Lower Austral and Tropical. The temperatures limiting three life areas formed in our limits are tabulated as follows, by Merriam :—These are based on the two laws "(1) *The northward distribution of animals and plants is determined by the total quantity of heat—the sum of the effective temperatures.* (2) *The southward distribution of Boreal, Transition zone and Upper Austral species is determined by the mean temperature of the hottest part of the year.*" Southern limit of the Canadian zone is defined by the iso-

therm showing a normal mean temperature of six hottest consecutive weeks of 64.4 degrees; of the Transition zone, ditto, 71.6 degrees; of the Upper Austral, 78.8 degrees. The northern limits of the Transition and Upper Austral zones are defined by the sum of normal, mean daily temperatures for the year above 43 degrees, which is 10,000 degrees for the Transition and 11,500 for the Upper Austral.

In the case of rare or exterminated species a series of records of their historic or more recent occurrence in the various parts of the two states is given by counties. These have been condensed and summarized from an extended correspondence with observers, historians, scientific students, trappers, furriers and sportsmen, some of whom, very old men, have since died, and their valuable knowledge of pioneer conditions in our limits would have largely gone with them had it not been thus recorded.

The habits and economic relations of most of the species are touched upon; those of greater interest, because so little known, as popularly misjudged or now exterminated, are more fully treated. In this connection it may be stated that there is only one species of *native* mouse in Pennsylvania and New Jersey, namely, the mole mouse, underground meadow mouse, or pine vole, *M. pinetorum*, whose food habits may be said to be so noxious as to make its extermination a desideratum. Moles, shrews and common meadow mice are greatly misunderstood even by those who profess to study them from an economic point of view. The status of the rapacious carnivora —skunks, weasels, minks, coons, bears, wild cats, foxes, etc.—which still form a large part of the living population of our forests, deserves as thorough study as has been recently given by the United States Department of Agriculture to rapacious birds. From the researches of Dr. Warren in Pennsylvania along this line we may predict that the popular verdict on these vagabonds will in many cases be found faulty. The commercial importance of many so-called "injurious" mammals, which yield either food or furs to man, is far greater than many realize. For instance the trade, and consequent profits, arising from the trapping of muskrats in the Delaware Valley alone amounts to many thousands of dollars annually, and offsets a hundred fold their destruction of dikes, dams, forage crops or grain. The bodies of these muskrats are rarely wasted, being so prized in Cumberland Co., New Jersey, as to have a standard market value of five to eight cents each.

The *Cetacea*, or Whales and Dolphins, generally ignored in mammal study because of the confusion so long existing as to their character, identity and habits, have been given special attention, forming as they do, such a numerous representation in the waters of New Jersey. No less than eighteen species of these leviathans, ranging in length from 5 to 80 feet, wander to or now exist off our shores, some of the largest entering tidewater as far inland as Trenton. Nine additional extinct whales roamed

in the once tropical waters which covered southern New Jersey during the Miocene period. Whaling formed, at one time, an industrial feature of the New Jersey coasts, but has long been abandoned.

Species now extinct in our limits, which formed an important role in the domestic economy of our great-grandfathers are the Bison, Wapiti or Elk, Beaver, Cougar or "Panther" and Wolf. The bison, only a straggler east of the Susquehanna, and never abundant in Pennsylvania in the white man's memory, was last killed in Union Co., Pa., about 1800. The last Pennsylvania Elk or Wapiti was killed in Elk Co., in 1867 by Cornplanter Indians from the Cattaraugus Reservation. This animal was formerly abundant over the greater part of the state in the higher grounds, and was used as food. Though the native Beaver has been practically exterminated in our limits since 1875 there is a colony of wild beavers in Monroe Co., Pa., and several others in Sussex Co., N. J., all of which, there seems little doubt, are descendants of escaped imported beavers from Rutherford's game preserve near Allamuchy, Warren Co., N. J. They are increasing, and laws are being enacted for their preservation. The last Pennsylvania Cougars or "panthers" of which I have absolute proof of capture were a male and a female, killed in Clinton Co. by George Hastings in 1871. A Centre Co. specimen is recorded in the bounty records of that county for 1886, but I have been unable to verify its reliability. Others have been reported killed as late as 1893, but are of doubtful standing. Native Wolves apparently existed in Pennsylvania as late as 1890. All wolves killed since then seem to have been importations liberated by bounty thieves or escaped from traveling shows. Wolfish dogs are a perennial source of local wolf stories. The Canada Lynx, never numerous here, probably lingers in solitary cases in the northern wilds of Pennsylvania. Bears, Wild Cats and Foxes are increasing in our extensive deforested districts.

The list of fossil mammalia found in Pennsylvania and New Jersey greatly exceeds that of the rest of the United States east of the Mississippi river. This is due to the discovery of the numerous fossil-bearing limestone caves and fissures in the Delaware valley, and to the researches of Leidy, Marsh and Cope among these and in the marl beds of New Jersey.

Of mammals strictly non-recent, our list of fossil mammalia embraces the following: Edentates or giant sloths, 5 species; Sirenians or aquatic manatees and dugongs, 2; Cetaceans or whales and dolphins, 9; Ungulates, such as the elephant, rhinoceros, tapir, horse, peccaries, deer and wild oxen, 16; Rodents, such as pikas, giant beavers, rats and squirrels, 10; Pinnipeds, such as walrus and sea leopard, 3; Carnivores, such as sabre-tooth cats, cave bears, skunks and otters, 15, and Insectivores, such as shrews, 1. In all there are 61 species of strictly fossil non-existent species recorded from our limits, the greater part of which were originally discovered in Pennsylvania

and New Jersey. If we add to these the 30 species found associated in the fossil state with the others, but which are identical with existing species, we have a list of 91 species of fossil mammalia recorded from Pennsylvania and New Jersey. Comparing this with the list of species native to and recently existing in the two states and which numbers 71 species and 25 subspecies or geographic races, we have the rather extraordinary result of a known extinct mammalian fauna of two eastern states exceeding their existing mammal fauna. This is the more noteworthy in that nearly all of the terrestrial extinct species have been found in pleistocene, drift or terrace periods, which are supposed to so closely antedate the present age. In contrast with this I may mention that the known extinct mammalian fauna of New York, as given recently by Miller, only numbers 5 species. Another interesting fact, shown by our list, is the former existence in Pennsylvania and New Jersey of living species now confined to the Arctic and sub-Arctic faunæ of Canada. Of these I may mention the caribou, musk ox, moose, wolverene and walrus. Of the southern or tropical fossil genera, once very abundant in the Delaware Valley, none of the characteristic Sirenians giant sloths, shark-toothed dolphins, tapirs, peccaries, mastodons, rhinoceros or sabre-tooth cats now exist anywhere in the earth. These are two of the many interesting proofs of the Arctic source of Postpliocene extinction.

It will naturally be asked, "What previous publications have been made regarding the mammalogy of Pennsylvania and New Jersey?"

The most pretentious, and in fact the only work relating to the entire state of Pennsylvania is found in much scattered form in Dr. B. H. Warren's part of the book entitled "Diseases and Enemies of Poultry," published in 1897 by the Pennsylvania Department of Agriculture. In this many mammals are treated at length from the economic standpoint, and incidentally a large amount of valuable information, secured from residents of the state, has been recorded regarding other species. As a book of general reference, however, or as a list of species of Pennsylvania mammals, the book makes no pretensions. A few local Pennsylvania county lists, almost worse than useless because misleading, "have been inserted in older histories." The same may be said of the local county literature relating to New Jersey. Dr. C. C. Abbot's list of mammals, published in the appendix to the "Geology of New Jersey" in 1868, is the only one relating to the recent mammalia of that state worthy of mention. It enumerates forty-seven species, about one-half of the number now known. Prof. E. D. Cope's list of extinct New Jersey mammals in the same book includes only twenty species, nearly all of which were based on specimens from the marl beds. This number, in the light of subsequent discoveries, is nearly doubled.

Since the studies just summarized were begun, twelve existing species, not previously known to occur in Pennsylvania and New Jersey, have been there

discovered. Of these, four, a small weasel, a native cave rat larger than the Norway rat, a red-backed wood mouse or vole, and a lemming vole, the former two from Pennsylvania, the latter from New Jersey, have been described as new to science.

The specific synonymy used in the present paper is strictly confined to a double literary reference; first, to the earliest use of the name accompanied by an original description of the species; secondly, to the first use of the binomial or trinomial which I have considered applicable to it in the light of present knowledge. The unpublished quotations from correspondents are succeeded by their last names only, and a list of these with their addresses given in full at the end of the paper. Published quotations are accompanied by references. No bibliographic list has been prepared owing to the very limited number of references of importance relating to our mammals except those published in Philadelphia Journals of the Academy of Natural Sciences, the American Philosophical Society, and in the American Naturalist. The measurements given are in millimeters, their equivalents in inches being given in brackets following. It may be explained that the "*Type Locality*" is the place or region where the specimen or specimens forming the original description of the species, binomially named, was a native.

The excellence of the illustrations is largely due to the skillful reproductive photography of Mr. H. Parker Rolfe, of Philadelphia.

Space fails me to here express more particularly the kind assistance rendered by the many correspondents whose names are given in the appendix. They have my grateful thanks.

Audubon, N. J., April 11, 1903.

LIST OF RECENT MAMMALS INDIGENOUS TO PENNSYLVANIA AND NEW JERSEY.

Class MAMMALIA.

Order MARSUPALIA; Marsupials.

Family DIDELPHIDÆ; Opossums.

Genus *Didelphis* Linnaeus, Systema Naturæ, 1758, Vol. I., p. 54.

Northeastern or Virginia Opossum. *Didelphis virginiana* Kerr.

1792. *Didelphis virginianus* Kerr, Animal Kingdom, Vol. 1, Systematic catalog inserted between pages 32 and 33; description on another page.

Type locality.—Virginia (Colonial).

Faunal distribution.—New York to Florida, west to Mississippi valley. Formerly confined to austral zones; now invading the transition zone.

Distribution in Pa. and N. J.—Variably abundant in middle and southern counties in all situations except in the mountain summits; extending northward in lessening numbers along river valleys to and into New York state from Lake Erie to the Hudson River. With the deforesting of the mountains invading large areas of the Alleghanian regions previously unknown to them. Equally "at home" in the lumber piles and hen roosts of the town as among the untrodden haunts of the wilderness.

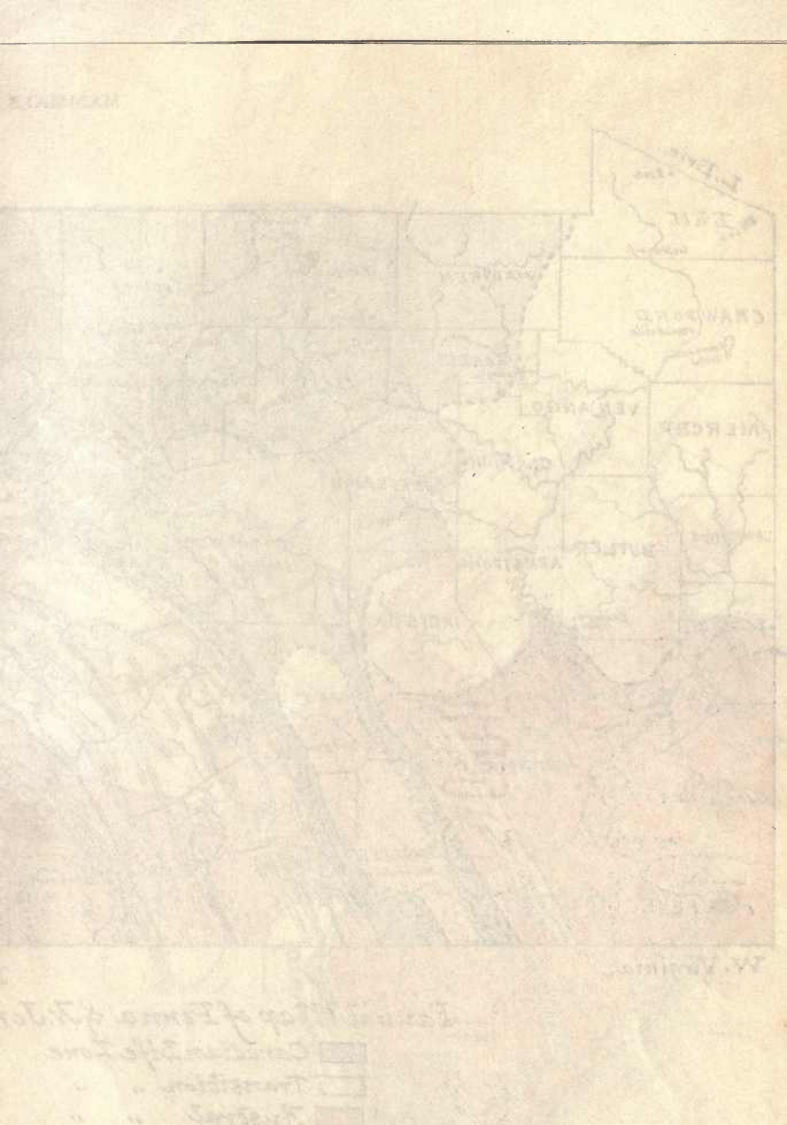
Records in Pa. (extralimital only given):

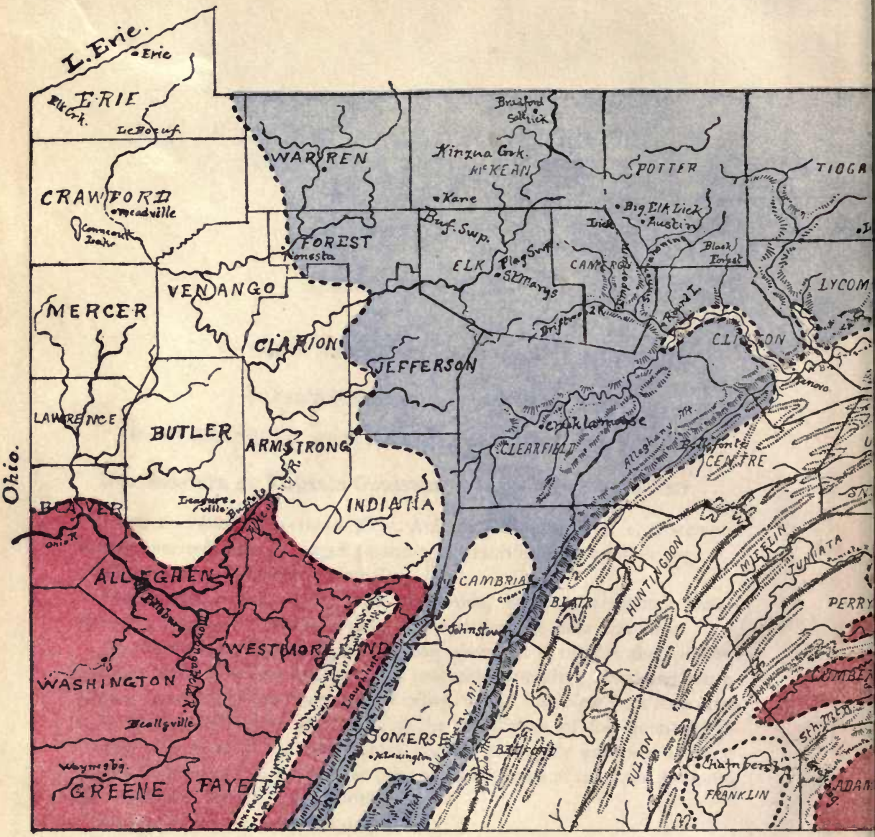
Armstrong and Butler Cos.—"I have examined specimens from the Buffalo Creek region of these two counties."—Todd, 1902.

Cameron Co.—"Last winter (1895) two were brought to Emporium."—Larrabee.

Centre Co.—Rare, and at lower levels only. One killed at State College in 1895.—Fernald.

Clinton Co.—Specimen in Pierce's collection taken near Renovo. I saw tracks of one, Nov., 1898, along the Sinnemahoning at Round Island.—



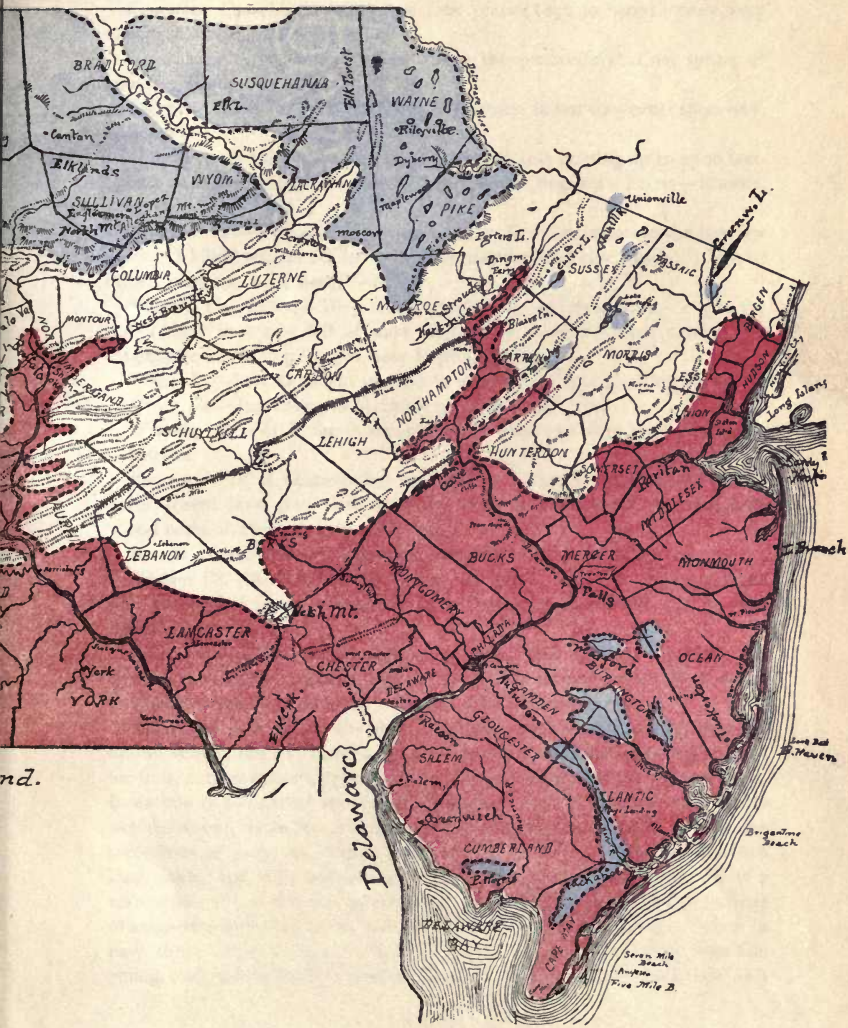


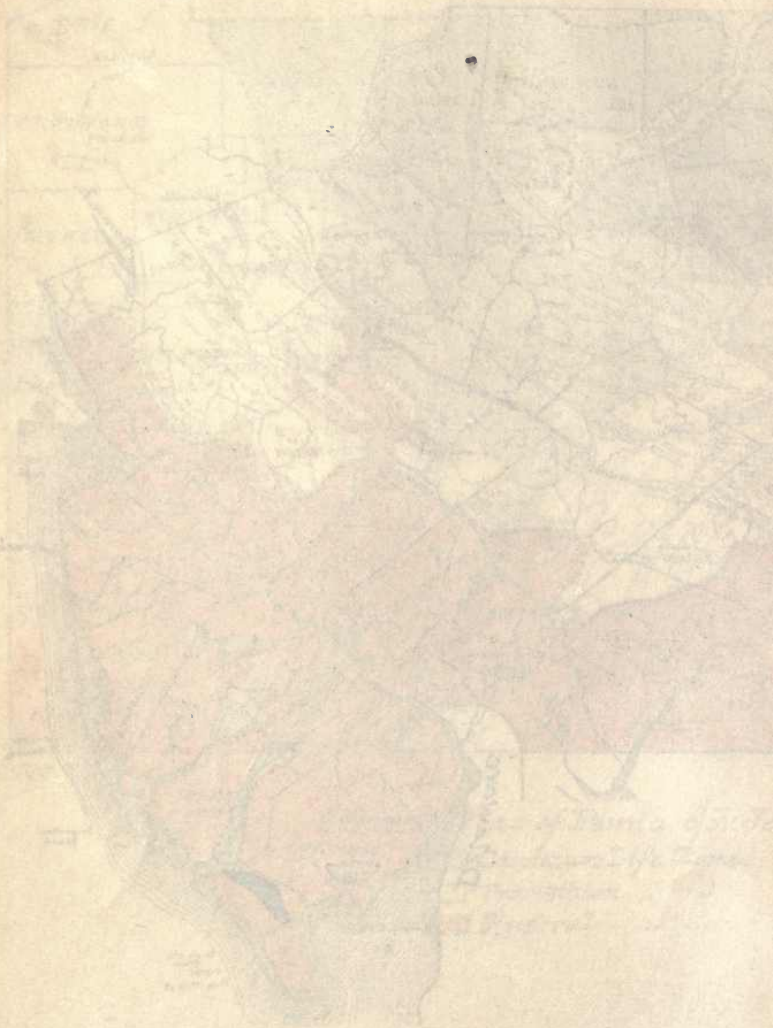
Faunal Map of Penna & N. Jersey.

Canadian Life Zone.

Transition " "

Austral " "


York.
BRADFORD
SUSQUEHANNA
Elk.
Bk Forest
WAYNE
Canton
Rileyville
Elklands
WYOM
LACKAWANNA
Dyberry
SULLIVAN
North Mt.
Moscow
PIKE
Unionville
Delaware R.
COLUMBIA
LUZERNE
Paupack L.
Ding
SUSSEX
PASSAIC
BERGEN
MONTOUR
CARBON
Blairstown
MORRIS
ESSEX
HUDSON
Long Island
SCHUYLKILL
LEHIGH
NORTHAMPTON
HUNTERDON
MIDDLESEX
Raritan
MONMOUTH
LEBANON
BERKS
BUCKS
MERCER
Phila.
LANCASTER
Kittatinny Mt.
MONTGOMERY
CHESTER
DELAWARE
OCEAN
Burlington
CAMDEN
Atlantic
GLOUCESTER
SALEM
Greenwich
CUMBERLAND
ATLANTIC
Brigantine Beach
Delaware
BAY
CAPE MAY
Seven Mile Beach
Five Mile B.
nd.



Rhoads. Catch one in 5 or 6 years in bottom land; also caught one in bear trap on top of mountain (1800 ft.) near Round Island.—Nelson, 1896.

Columbia Co.—More plenty last four years (1896 to 1900); once very rare at Fishing Creek.—Buckalew.

Erie Co.—"A skull was picked up on the peninsula at Erie, spring of 1900."—Todd.

Lycoming Co.—Coming in rarely at Eaglesmere in last six years (1890–96). —Bennett.

Monroe and Pike Cos.—Rare on Pocono plateau, coming up to 1500 feet. Specimens taken at Porter's Lake. Less rare at Dingman's Ferry.—Rhoads, 1895.

Somerset Co.—"Becoming numerous near New Lexington in the last few years. I killed one on my hen roost two months ago (Nov., 1900). Ten or fifteen years ago none here."—Moore.

Sullivan Co., Lopez.—They reach the top of our mountains. I saw the trail of one in a new fall of snow in January, 1901, near our camp. We caught one in (March?) 1901 near Lopez.—Behr.

Tioga Co.—Several caught in 1898 in vicinity of Canton.—Cleveland.

Union Co.—Increasing at Mifflinburg.—Chambers, 1901.

Wyoming Co.—G. F. Smith records one in 1896 as a very rare occurrence. —Warren.

Records in N. J. (extralimital only given).—The opossum probably was never absent from any part of New Jersey as it once was in the more boreal parts of Pennsylvania.—Rhoads.

Bergen Co.—Found sparingly along the Palisades.—Rhoads, 1902.

Hudson Co.—Audubon states (Quad. N. Amer., Vol. 2, p. 124) opossums were sometimes found within five or ten miles of New York City in New Jersey.

Passaic Co.—Two were captured in 1895 and 1896 by hunters near Greenwood Lake; considered rare at that place. Occasional on the Bearfoot Mountains (700 to 1400 feet). Rhoads, fide Leonard Wright.

Habits, etc.—Spending the day in hollow trees, logs, deserted burrows, drains, sewers, rail and brush piles, ricks and outbuildings; prowling at night for fruit, nuts, mammals, eggs, birds, reptiles, mollusks, insects and crustacea. In extremity a cannibal and eater of carrion. Owing its urban existence to non-resistance, fecundity, omnivorous diet and a prehensile tail. Producing sometimes as many as sixteen young, which at birth are three-fourths inch long, naked and with rudimentary hind limbs; each securely attached to a teat within the abdominal pouch, from which they emerge when of the size of small rats and cling by tail and feet to the body of the parent. Stated to have three litters in a year. Its habit of eating wild birds, their eggs and young, and its fondness for poultry offset in some degree its usefulness as a

scavenger, an eater of injurious animals, a producer of furs and food for man. It may be safely classed as a useful animal whose overabundance in populous districts may be easily checked by the trapper's arts.

Order CETACEA; Whales and Dolphins.

Family BALAENIDÆ; Whalebone or Baleen Whales.

Genus *Balaena* Linnaeus, Systema Naturae, 1758, Vol. I, p. 75.

Black Right Whale. *Balæna glacialis* Bonnaterre.

1789. *Balæna glacialis* Bonnaterre, Tableau Encycl. and Method. des Trois Regnes de la Nature, Cetologie, p. 3.

Type locality.—Near the coasts of Norway and Iceland.

Faunal distribution.—North Atlantic Ocean.

Distribution in Pa. and N. J.—Rare along the New Jersey coast in winter; sometimes ascending Delaware and New York Bays.

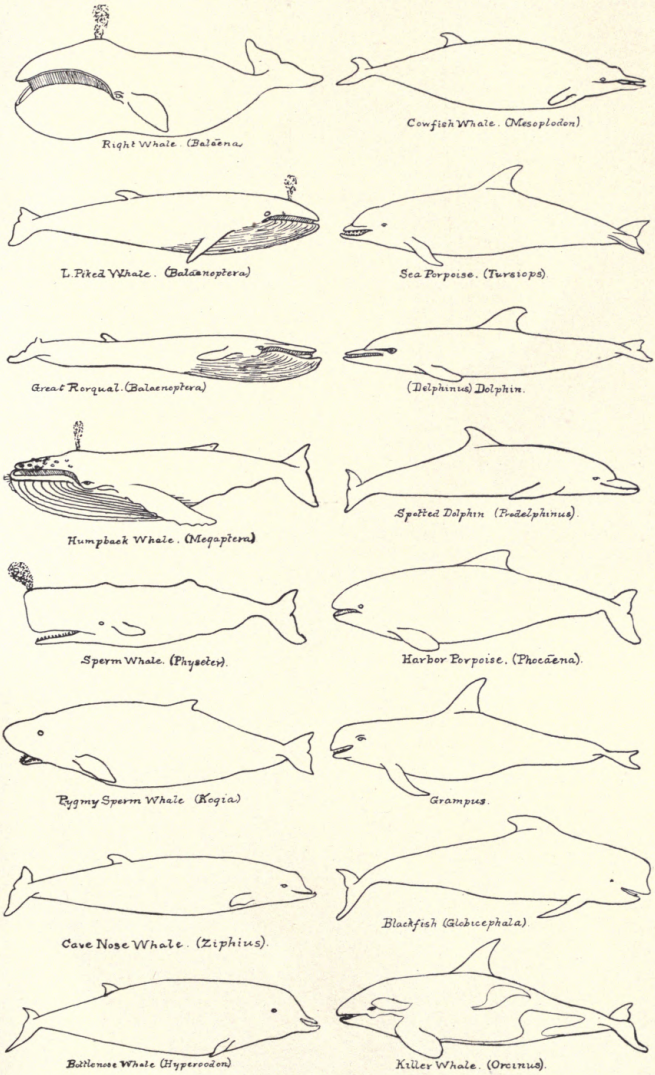
Habits, etc.—Once abundant in the north Atlantic and nearing extinction, but now increasing in numbers.—Holder, 1883. The baleen or sieve-like bristles within the mouth separate the minute crustaceans and pteropods which swarm in immense shoals where it feeds. To secure these it takes a mouthful of water and in the act of closing it and ejecting the water the baleen project from the palate automatically and close together in front of the ejected water, straining out and retaining any food which it contains. True says (Cat. Aquat. Mam. U. S. N. M., Ind. Fish Exhib., 1884, p. 13) that this species "is believed to have been the object of very considerable fishery in early colonial times, but has disappeared entirely for many years."

Records in Pa. and N. J.:

"They were formerly abundant about the mouth of the Delaware river. A letter of William Penn dated 1683 states that eleven were taken that year about the Capes. Five specimens are stated to have been seen in the Delaware river since that time, and two of great size are recorded to have been seen on the coast of Maryland."—Cope, Proc. A. N. Sci., Phila., 1865, p. 168. The type specimen of Cope's *Balaena cisarctica*, now considered a synonym of *B. glacialis*, was taken in 1862 in the river opposite Philadelphia. Its skeleton is now mounted in the museum of the Academy of Natural Sciences of Philadelphia. See Proceeeings of the Academy above cited.—Rhoads, 1902.

New York Bay.—"Some are known to enter New York Harbor."—Cope, l. c.

A specimen, apparently of this species, is in the Rutgers College Museum,



WHALES AND DOLPHINS (*Cetaceans*).

taken from the Raritan River, near Sayreville, N. J., May, 1874, by Capt. E. G. Roberts. It is 42 feet long.—Rhoads.

One of this species "was captured off the New Jersey coast by a crew of experienced Egg Harbor whalers by the usual method of harpooning. It was exhibited during several weeks of the spring of 1882" after being brought to New York City. It was not preserved. See Holder, Bull. Amer. Mus. N. Hist., vol. i, p. 106.

This is probably the species recorded by Ord in 1815 in Guthrie's Geography, p. 292, as follows: "A young whale of this species [*Balaena mysticetus* of his list] was taken in the Delaware in the vicinity of the [Trenton] Falls in the latter part of the year 1814; and exhibited at Philadelphia."

"*Balaena mysticetus*.—Has been twice known to occur within the limits of Delaware County."—Cassin, in History of Del. Co., Pa., 1862.

Genus *Balaenoptera* Lacepede, Histoire Naturelle des Cetacees, 1803–4, p. xxxvi, in Tableau des Ordres.

Little Piked Whale; Least Rorqual or Fin Back. *Balænoptera acuto-rostrata* Lacepede.

1803–4. *Balænoptera acuto-rostrata* Lacepede, Histoire Naturelle des Cetacees, p. xxxvi, Tableau des Ordres, pp. 134, 141.

Faunal distribution.—Atlantic Ocean, from Davis Straits to the Mediterranean Sea and New Jersey.

Distribution in Pa. and N. J.—Very rare on the New Jersey coast. A doubtful specimen recorded from Pennsylvania waters.

Habits, etc.—This smallest of the fin-backs, rarely exceeds 30 feet in length. It associates with the large rorquals and feeds largely on fish, though its baleen undoubtedly enables it to net crustacea, etc. It is distinguished from other whales by its white under parts, including the under side of tail and flippers, and by the broad white band which crosses the outer side of the latter. The sharp, piked snout gives it its name.

Records in Pa. and N. J.—"A pike-headed whale was caught some years since in the Delaware, near Reedy Island and shown in Philadelphia and New York."—Ord, Guthrie's Geography, 2d Amer. ed., 1815, p. 292. As this specimen was subjected to examination, the peculiarity of its head, as indicated in the specific name given by Ord, would lend color to the correctness of the identification. It may, however, have been a *Megaptera*, as Ord previously names it *M. boops*.

Mr. True sends me the following record of a capture: "Long Beach, N. J., fall, 1866." This probably refers to the specimen recorded by Cope, Proc. A. N. Sci., Phila., p. 221, cast ashore opposite Westecunk on the outer side

of Little Egg Harbor near the residence of Wm. A. Crane. Cope makes it the type of a new genus (pp. 223-24) *Agaphelus*, and names it *Agaphelus gibbosus*.—Rhoads, 1902.

General notes on baleen whales of Pa. and N. J.—The following relate chiefly to whalebone whales in our limits of the Rorqual and Right Whale species in this list: "In 1688 Phineas Pemberton of Pennsbury records one up as far as Trenton Falls [Delaware River]." In 1733 "two whales were chased in the Delaware, opposite Philadelphia, but escaped.—Watson's Annals."

In 1693 Thomas Leaming settled at Cape May, N. J., and that winter went whaling, killing 8 whales, "5 of which they drove to the Hoarkills." In 1691 the whaling industry of Cape May was so profitable that the business of a cooper for oil barrels "made the demand and pay for casks certain."—See quotations from MSS. notes of T. Leaming in Geology of Cape May Co., N. J., 1857, pp. 175, 176. Master Evelyn's Letter in Plantaganets' "New Albion," 1648, says: "There is much variety of . . . fish, whales and grampus," etc., referring by implication to the southernmost section of New Jersey. In the "Historical Collections of New Jersey," Barber and Howe, 1865, p. 369, there is a quotation from the manuscript of J. F. Watson, under date of July, 1833, which states: "I was surprised to learn from old Stephen Inman, one of the twelve islanders of Long Beach, himself aged 75 years, that he and his family had never ceased to be whale catchers along this coast. They devote themselves to it in February and March. Generally catch two or three of a season . . . . Whalebones of large size are seen bleaching on the sand." On page 41 of the Historical Collections, just cited, we read that whales were "numerous in winter on the coast and in the bay, where they frequently grounded;" also, that on the 15th of February, 1668, a commission was granted to a Company in Elizabethtown [Elizabeth], N. J., to take whales for 3 years. During that period a whale was cast ashore at Navesink and delivered to the Company. Vanderdonck in his Description of the New Netherlands says: "Whales are numerous in winter on the coast and in the bay, where they frequently ground on the shoals and bars."

A whale 40 feet long, of a whalebone or baleen species, was taken in June, 1874, at South Amboy, N. J.—See Forest and Stream, vol. 2, p. 267. This is probably the one in the Rutgers College Museum, previously recorded under *Balaena glacialis*.—Rhoads, 1902.

Mr. H. W. Hand wiites me that a few of the large whales are seen annually off Cape May, usually in the early winter.—Rhoads, 1902.

Great Finback; Rorqual. *Balænoptera physalus* (Linnæus).

1758. *Balæna physalus* Linnæus, Systema Naturæ, p. 75.

1897. *Balænoptera physalus* True, Proceedings U. S. National Museum, No. 1163, p. 633.

Type locality.—Spitzbergen (Marten's "Finfisch").

Faunal distribution.—The common large whale of the Atlantic Ocean and the one most frequently stranded upon our coasts.

Distribution in Pa. and N. J.—Occasional along the coast of N. J., sometimes entering bays.

Habits, etc.—Dr. True writes me that this is "a migratory animal and the specimens stranded are probably from passing schools." No doubt these stranded animals on our New Jersey coast have been often crippled far at sea by collision with passing vessels. The food of this species is chiefly fish, herring and smelts being a favorite sort. It grows 60 to 70 feet long. Species of *Balænoptera* are said to be able to stay under water 8 to 12 hours. They are inoffensive when attacked. No doubt some of the stranded specimens have been lured into shallow water on the New Jersey coast by the schools of "moss bunkers."

Records in Pa. and N. J.—A jaw, apparently of this species, was found by me on the beach near Beach Haven, N. J., about 1885.—Rhoads. Mr. True informs me that a specimen from Delaware Bay was stranded near Fenwick's Island Life Saving Station, Delaware, May 2, 1896.

Great Blue Whale. *Balænoptera musculus* (Linnæus).

1758. *Balæna musculus* Linnæus, Systema Naturæ, p. 76.

1898. *Balænoptera musculus* True, Proceedings United States National Museum, No. 1163, p. 633.

Type locality.—Firth of Forth, Scotland (Sibbald's spec.).

Faunal distribution.—North Atlantic Ocean southward to shores of England and New Jersey; a larger and more northerly ranging species than the common Finback.

Distribution in Pa. and N. J.—Occasionally noted on the N. J. coast.

Habits, etc.—This, said to be the greatest of all animals living or extinct, is much larger than any other species of whale. The "sulphur-bottom" form found in the Pacific has been taken nearly 100 feet long. They can swim at the rate of 12 miles an hour. Their food is mainly derived from schools of the smaller-sized fish.

Records in N. J.—Cape May Co., Ocean City. A large specimen was stranded October 1, 1891. Its skeleton (No. 5316, A. N. S. Catalog.) is in the museum of the Academy of Natural Sciences of Philadelphia. It was measured in the flesh by Messrs. J. E. Ives and F. W. True, and found to be 67 feet long. Prof. E. D. Cope describes it at length in Proc. A. N. Sci., 1891, p. 474.

Genus *Megaptera* Gray, Zoölogy Voyage Erebus and Terror, 1846, p. 16.

New England Humpback Whale. *Megaptera nodosa* (Bonnaterre).

1789. *Balæna nodosa* Bonnaterre, Tableau Encycl. et Methodique; Trois Regnes de la Nature; Cetologie, p. 5.

1898. *Megaptera nodosa* True, Proc. U. S. National Museum, Nov. 4, Vol. 21, p. 635.

Type locality.—Shores of New England (Dudley in Phil. Trans. Roy. Soc., Lond.).

Faunal distribution.—The East Atlantic form of the *M. boops* of authors is numerous on the entire Atlantic coast of the United States.

Distribution in Pa. and N. J.—Occurring off the New Jersey coast; specimens having been taken on the coast of Maine, Massachusetts and Virginia, and described by Cope (Proc. A. N. S., Phila., 1865, 1866) as *M. osphyia.*

Habits, etc.—Owing to the poor quality of this whale it is avoided by whalers. It is distinguished from the rorqual by the great length and size of its fins. The hump-like form of the dorsal fin gives it the common name. They are extremely variable in color, black, white and gray being variously combined. The Megapteras are the only baleen whales which "breach" or leap clear of the water. They are very playful, striking each other resounding whacks with the immense flippers and thrashing about in and out of the water so as to be heard miles away in favorable weather. They have been known to spout twenty feet high in calm weather. The young number one to two. They feed on crustaceans and fish.

Records in Pa. and N. J.—It is possible that the record of a "pike-headed whale" given by Ord (see under *Balænoptera acutorostrata* above) as taken in the Delaware river, may have referred to this species. I know of no records of the stranding of this whale on our shores.—Rhoads, 1902.

Family PHYSETERIDÆ; Sperm or Toothed Whales.

Genus *Physeter* Linnaeus, Systema Naturæ, vol. 1, 1758, p. 76.

Sperm Whale; Cachalot. *Physeter macrocephalus* Linnaeus.

1758. *Physeter macrocephalus* Linnaeus, Systema Naturæ, Vol. 1, p. 76.

Type locality.—Seas of Europe.

Faunal distribution.—Temperate and tropical seas of the world. Rarely reaching arctic seas.

Distribution in Pa. and N. J.—Rarely washed ashore on the New Jersey coast. Not frequenting sandy seacoasts or shallow waters as do the rorquals.

Habits, etc.—This huge animal, the most desirable from an economic

standpoint on account of its "sperm oil," subsists principally on the giant squids and cuttle fish and larger species of true fish which it quickly crushes in its toothed jaws. The color is black above, shading to gray. Its enormous head, shaped above like a rounded box, is nearly one-third the entire length of the animal. The flippers are small and it has only one blow-hole instead of two, as in the toothless baleen whales. These whales sometimes attack boats and even ships, crushing or staving them in.

Records in N. J.—Mr. True kindly furnishes me with the following data: Cape May, N. J., Aug., 1882, a scapula, radius and ulna in U. S. National Museum, No. 20,872.—Young, 18′–6″ long. Brigantine Beach, N. J., May 4, 1900. Young male.

Genus *Kogia* Gray, Zoölogy Voyage Erebus and Terror, Vol. 1, 1846, p. 22.

Pigmy Sperm Whale. *Kogia breviceps* (De Blainville).

1838. *Physeter breviceps* De Blainville, Annals Anat. & Physiol, vol. 2, p. 337.

1846. *Kogia breviceps* Gray, Zoölogy of Voy. Erebus and Terror, Vol. I, p. 22.

Type locality.—Cape of Good Hope.

Faunal distribution.—Temperate and tropical seas of the world.

Distribution in Pa. and N. J.—Stranded at various points on the New Jersey coast.

Habits, etc.—This seems to be the smallest of our whales. Its extremely short nose and head distinguish it from the dolphins with which it has resemblance because of small size. Their habits have not been put on record. The color of a New Jersey specimen, as given by True, is dark above, light beneath, the line of separation being straight along the middle of the side above the flippers.

Records in N. J., Atlantic Co.—Barnegat City, N. J., Oct. 24, 1885, female. —Cat. No. 15,222, U. S. National Museum. Loveladie's Id., N. J., Oct. 25, 1885, male.—Cat. No. 15,223, U. S. National Museum. Atlantic City, N. J., Apr., 1888, Male.—Cat. No. 22,893, U. S. National Museum.

Cape May Co.—Corson's Inlet, Sea Isle City, Feb. 18, 1894, a male, 10 feet long; stranded on the beach, considerably mutilated. In Wistar Institute Museum, University of Pennsylvania. Ocean City, Nov. 2, 1899, a male, 11 feet long, weighing about 700 pounds. No. 3,700, catalogue of the Wistar Institute. This fine specimen was driven into a small cove by fishermen and killed.

Monmouth Co.—Spring Lake, April 17, 1883; stranded on shore, Cat. No. 13,738, U. S. National Museum, Wash'n. Figured in Hist. Aquat. Amin., U. S. Fish Com., 1884, pl. 2.

Family ZIPHIIDAE; Bottle-nosed or Beaked Whales.

Genus *Ziphius* Cuvier, Ossemens Fossiles, 1823, Vol. V, p. 352.

Cuvier's Beaked Whale. *Ziphius cavirostris* Cuvier.

1823. *Ziphius cavirostris* Cuvier, Ossemens Fossiles, Vol. V, p. 352.

Type locality.—Mediterranean coast of France.

Faunal distribution.—Temperate and tropical seas of the world.

Distribution in Pa. and N. J.—A rare straggler to the coast of New Jersey.

Habits, etc.—Not known; at least undescribed with certainty. It was originally named from a fossil skull fragment and subsequently found to be also an existing species. The skull is much hollowed frontally, the premaxillae and nasals rising high to the vertex of the cranium and projecting forward over the nares. There are no functional teeth, except two small ones in the apex of the lower jaw. Length about twenty feet.

Record in N. J., Atlantic Co.—At Barnegat City an adult female 19 ft. 4 in. long, was cast ashore Oct. 3, 1883. Its color was "light stone-gray, darkest on the belly," an unusual color pattern. This is the first and only record of the genus in the northwestern Atlantic.—See True, Science, Vol. II, 1883, p. 540.

Genus *Hyperoödon* Lacepede, Histoire Naturelle des Cetacees, 1803–4; Tableaux des Ordres, p. xliv.

Bottlenose Whale; Pug-Head Whale. *Hyperoödon ampullatus* (Forster).

1770. *Balaena ampullatus* Forster, Linnaean Travels, Kalm, Vol. I, p. 18, foot-note.

1902. *Hyperoödon ampullatus* Rhoads, Science, N. York, Vol. 15, p. 756.

Type locality.—Coast of Scotland.

Faunal distribution.—North Atlantic Ocean; straggling southward to Rhode Island and Scotland.

Distribution in Pa. and N. J.—Likely to again occur off the coast of New Jersey, one specimen having been taken in New York Bay, another at Newport, Rhode Island.

Habits, etc.—This whale is common is the far north. It is small (20 to 30 feet), and the male has a square, high forehead suddenly rising from the beaked snout. They go in small herds among the ice and are very tame, leaping far into the air and diving head first like a fish. They go to great depths to feed on a species of cuttle fish about 6 inches long. They migrate southward in winter, rarely reaching the New England coast. This species

has a beak like the dolphin's, only shorter. No teeth are visible above the gums, two at the apex of the lower jaw are the largest, but non-functional.

Records in N. J.—New York Bay.—De Kay records a specimen taken in the "lower" bay in 1822; said to be a female.—Zoöl. N. York, Vol. I, 1842, p. 131.

Kalm says it was common during his voyage to America almost all the way across the Atlantic to the shores of the United States.

Genus *Mesoplodon* Gervais, Annal. Scien. Nature, series 3, 1850, vol. 14, p. 16.

Sowerby's Whale, Cowfish. *Mesoplodon bidens* (Sowerby).

1806. *Physeter bidens* Sowerby, British Miscellany, p. 1.

1877. *Mesoplodon bidens* Flower, Proceedings Zoölogical Society, London, p. 684.

Type locality.—Near Brodie House, Elginshire, Scotland.

Faunal distribution.—Not determined.

Distribution in Pa. and N. J.—Recorded once from the N. J. coast.

Habits, etc.—Not described by authors. Known from the other Ziphoids by generally having the two, solitary, mandibular teeth set nearly half way back from the apex of the jaw, and sometimes these are of great size, actually meeting over the rostrum. In *bidens* they are less exaggerated.

Record in N. J., Atlantic Co.—A male, 12½ feet long, was stranded at Atlantic City, March 28, 1889, and was secured for the U. S. National Museum at Washington, by Mr. F. W. True. Cat. No. $\frac{16446}{23346}$.—See Proc. Roy. Phys. Soc., Edinb., vol. 10, p. 13.

Family DELPHINIDÆ; Dolphins and Porpoises.

Genus *Tursiops* Gervais, Histoire Natur. des Mammiferes, 1855, vol. 2, p. 323.

Bottlenose Dolphin, Common Porpoise. *Tursiops tursio* (Fabricius).

1780. *Delphinus tursio* Fabricius, Fauna Groenland., p. 49.

1864. *Tursiops tursio* Gervais, Comptes Rendus, p. 876.

Type locality.—Coast of Greenland.

Faunal distribution.—Atlantic Ocean, from Greenland to France and the West Indies.

Distribution in Pa. and N. J.—The commonest species of *Delphinidæ* on the coast of N. J. Rarely entering bays and rivers.

Habits, etc.—"A company, called the Porpoise Fishing Co., was incorporated under the laws of New Jersey, Feb. 1, 1894, and undertook the capture

of this species on a large scale at Cape May. Though numbers were taken the enterprise did not prove a success."—True, MSS. note, 1902.

They are most abundant in spring, rare in December and January, and decrease greatly by July. They associate in large schools, as many as 66 being taken in the nets at one haul during the spring migration. At this time the females are suckling young of various sizes, some of which had been born the previous winter and fall. The number of sexes is about equal. The average length is 9 feet. The largest taken at Cape Hatteras was 12 feet long, and yielded 24 gallons of oil. The color is purplish lead-gray above, the belly white, indistinctly separated by a line joining the base of the tail and angle of the mouth. The lower jaw projects beyond the upper. Their food is small fish. The oil is of superior quality, and the skin makes an exceedingly strong leather. The number taken at the Hatteras fishery in season of 1884–85 was 1,268.

Records in N. J., Cape May Co.—"Caught in numbers at Cape May."—Jordan, Man. of Vert. U. S., 1899, p. 333.

A specimen from Cape May, taken Sept. 1, 1884, is in the U. S. Nat. Museum. Another, taken at Turkey Gut, near Cape May, Oct. 8, 1883, is also in the National Museum. It is a skeleton of a female, No. 20,962.—True, 1902.

The Academy of Natural Sciences of Philadelphia "has been presented with a skeleton of a very old individual by Dr. Howell of this city, who obtained the animal some years since from a fisherman's seine at Red Bank, below opposite this city."—Cope, Proc. A. N. Sci., Philada., 1865, p. 281. This specimen was here described, and named *Delphinus erebennus*. I am told that it is yet in the Academy's collection. It is considered by cetologists to be the same as *T. tursio*.—Rhoads, 1902.

Genus *Delphinus* Linnæus, Systema Naturæ, 1758, Vol. I, p. 77.

Common Dolphin; Ring-Eyed Porpoise. *Delphinus delphis* Linnæus.

1758. *Delphinus delphis* Linnæus, Systema Naturæ, Vol. I, p. 79.

Type locality.—Coast of Europe.

Faunal distribution.—Temperate and tropical waters of the Atlantic, Pacific and Indian Oceans, generally avoiding harbors and bays.

Distribution in Pa. and N. J.—Not certainly found in the limits of Penna. Living off the shores of N. J. Occasionally entering New York and (?) Delaware Bays. Jordan says it is scarce on the coasts of North America. Godman says they were abundant in 1827 in the bays and harbors of the Middle States.

Habits, etc.—The habits and popular names of the dolphins and porpoises on our coast are greatly confused, owing to their similarity in size and actions,

and the concealment of their watery surroundings. The common dolphin may be known from the bottle-nosed animal by its long snout and peculiar striped markings of the sides of body and head. It is a much slenderer animal than the harbor porpoise or herring hog which frequents our bays and rivers, the latter resembling in color and shape of head more closely the bottlenose. The latter, however, is not nearly as stout and round-finned as the harbor porpoise and has a "beak" wholly lacking in the latter species. This is "The Dolphin" of the ancients, mythology and fable. Its variegated colors, swiftness, sociability and abundance in the Mediterranean make it the most familiar of the Cetaceans. At the same time it has been so confused with other species as to make most accounts of it unreliable.

Records in N. J.—True records 2 specimens from New York Harbor and Bay.—Bull. Nat. Museum, 1889, pp. 56, 57.

Cape May Co., Ocean City.—A female containing foetus was presented to the Academy of Natural Sciences of Philadelphia in 1894. The skeleton of the adult is No. 5360, Coll. A. N. S., Phila.

Genus *Prodelphinus* Gervais, Osteographie des Cetaces, 1880, p. 604.

Spotted Dolphin. *Prodelphinus plagiodon* (Cope).

1866. *Delphinus plagiodon* Cope, Proceedings Academy Natural Sciences, Philadelphia, p. 296.

1889. *Prodelphinus plagiodon* True, Bulletin U. S. National Museum, No. 36, p. 66.

Type locality.—Unknown. Type is "No. 3,884 Mus. Smithsonian" Institution, Washington.—Cope. Probably from the east coast of United States.

Faunal distribution.—Abundant in the Gulf of Mexico and on the coast of the United States as far north as Cape Hatteras.—True, 1884. Stated by Jordan to reach the coast of N. J.

Distribution in Pa. and N. J.—The only mention that I discover referring this species to our fauna, is by Jordan in the 1899 edition of his Manual of the Vertebrates of Northern United States, page 333, in which he gives the habitat as "North Atlantic, south to N. J." He probably meant *South* Atlantic, *north* to N. J. As Mr. True is stated by Jordan in the preface to have "revised" his "Cetaceans," I conclude that "N. J." is considered by that gentleman within its range. Cope, in the Proc. A. N. S., 1865, p. 201, under "*D. clymene* Gray," records a "specimen in the Museum of the Academy from off New Jersey, presented by John Krider." This I have just examined and it appears to be *Prodelphinus plagiodon*. If so it is the only N. J. record known to me. Dr. True, who recently examined it, finds this skull to be identical with Gray's figure of *P. euphrosyne*. In this opinion I concur.

Remarks on habits, characters, etc.—In the second reference made at the head of this article True concludes this species is distinct from *P. dioris* (Gray.) The specimens he describes were taken, one in 1884, at Pensacola, Fla., the other at Cape Hatteras, later. Both were males, and he considers them the "most beautiful cetacean he ever examined," distinguished from *D. delphis* by the spotted gray body and the less falcate dorsal fin. The schools seen were very numerous at both localities. The organs of the Florida specimen showed that May and June was the rutting season. The length is 6 feet, the height of dorsal fin 9½ inches. The form of head and body is like *D. delphis*.

Genus *Phocæna* Cuvier, Regne Animal, Vol. I, 1817, p. 279.

Harbor Porpoise; Herring Hog; *Phocæna phocæna* (Linnæus).

1758. *Delphinus phocæna* Linnæus, Systema Naturæ, vol. 1, p. 77.

1888. *Phocæna phocæna* Jordan, Manual Vert. Animals of Nor. U. States, p. 331.

Type locality.—Coast of Europe.

Faunal distribution.—North Pacific Ocean, Atlantic Ocean from Baffin's Bay to France and Maryland; ascending bays and rivers, sometimes far above tidewater limits.

Distribution in Pa. and N. J.—Abundant on the seaboard, and in the bays and inlets of N. J., coming within the limits of Penna. in Delaware Bay and River as far up as Trenton Falls. Sometimes ascends the Raritan and Passaic Rivers and is a frequent visitor in New York Bay and the Hudson River beyond the Northern border of N. J.

Habits, etc.—This is pre-eminently a shore and river species, delighting in the surf of sandy beaches and following the shoals of herring and other fish from the bays into rivers and freshwater shoals scarcely deep enough to give them cover. It is known from other porpoises and dolphins by the clumsy rounded head (lacking a "beak"), and by the stout form and uniform dusky coloration. It is a small animal, averaging about 5 feet in length. Dr. Godman, who gives a most ample and graphic account of the dolphin in our harbors, says he has not seen the porpoise. Either he was mistaken in his identification or else the relative abundance of the two has since then become reversed.

Records in Pa. and N. J., Delaware River.—"Occasionally ascends the Del. R. to within the limits of [Delaware] Co."—J. Cassin, List of Quad. in "Hist. Del. Co., Pa.," 1862, Appx.

See Cope's *Phocæna lineata*. ♀ Type taken in N. Y. harbor in 1876, and descr. by Cope from spec. now in U. S. National Museum, Cat. No. 12,481,

P. phocæna, See Proc. A. N. S., 1876, p. 134. See True, Mon. Delph. ad ♀ Cape May, No. 13,359, rec'd Dec. 27, 1881.

The type specimen of *Phocæna lineata* Cope, which True considers the same as *communis* was taken in our limits, in New York harbor in 1876. True records two from Cape May in the National Museum.—Nos. 16,610, (a female), and 13,359. "They have been seen in the Delaware as high up as Trenton and are common in the Hudson north of the New Jersey State line." —Abbott, in Geol. N. J., p. 760.

Genus *Grampus* Gray, Spicilegia Zoölogia, 1828, p. 2.

Grampus; Cow Fish. *Grampus griseus* (Cuvier).

1812. *Delphinus griseus* Cuvier, Annals. de Museum, Vol. 19, p. 14, pl. 1, fig. 1.

1889. *Grampus griseus* True, Bulletin U. S. National Museum, No. 36, p. 125.

Type locality.—Bay St. Brieux, France (English Channel).

Faunal distribution.—North Atlantic and Pacific Oceans, Mediterranean.

Distribution in Pa. and N. J.—Known only from the coast of N. J.

Habits, etc.—This species associates with the black-fish and is rare in N. England waters and more so on the N. J. coast, while the black-fish (*Globicephala brachyptera*) is abundant. It is 12 to 15 feet long, has no upper teeth, about 10 in the lower jaw, the head high, short and rounded; the color bluish-black, variegated with irregular gray streaks and cloudings, beneath white. They can only mash and swallow their food, owing to absence of functional teeth.

Records in N. J.—Atlantic Co.—(1) Atlantic City, stranded Feb. 2, 1887. —True, Bull. U. S. Nat. Mus., No. 36, 1889, p. 183.—(2) Brigantine Beach, Mch. 31, 1895, female, Photo. in U. S. N. M.—True.

Genus *Globicephala* Lesson (Oeuvres Compl. de Buffon, 1828, Vol. 1, *fide* Agassiz), Noveau Tableau du Regne Animal, 1842, p. 200.

Northern Blackfish; Pilot Whale. *Globicephala melas* (Traill).

1809. *Delphinus melas* Traill, Nicholson's Journal, Vol. 22, p. 81.

1842. *Globicephalus melas* De Kay, Zoölogy of N. York, Mammalia, p. 132.

Type locality.—Coast of England.

Faunal distribution.—North Atlantic Ocean; south-west to Long Island, and the N. J. coast; south-eastward along the coasts of the British Isles.

Distribution in Pa. and N. J.—Occasionally reaching the coasts of N. J. in their wanderings southward.

Habits, etc.—One of the most abundant and valuable of the small whales of the northeast coast of N. Ameica. They average about 15 feet long, sometimes reaching over 20 feet, weighing about 1,000 lbs., and yielding 3 to 5 barrels of oil. The "porpoise jaw oil" from this whale is of fine quality for delicate machinery. The flesh is good food and much used for bait. They do not play like the porpoise, but often rise to blow and move leisurely along unless they are pursued by "Killers" (*Orcina*) or whalers, when they may be driven in great numbers on the beach and are generally thus captured. They feed on menhaden, herring, mackerel and squids, and give birth to their young in August. At birth these are 5 to 7 feet long. In winter they are absent from our shores, returning in June. The color is black without spots, a short narrow white area on belly. The head is short, rounded, and the forehead very high, rising at right angles from the end of snout. The lateral fins are remarkably shaped, like a long, curved cutlass blade. The teeth number 8 to 12 in each jaw, and are small, becoming lost in old age.

Records in N. J.—"Atlantic coast of N. America to N. Jersey."—True, Bull. U. S. Nat. Mus., No. 36, 1889, p. 184.

Ocean Co.—A skull of this species, No. 3,014, from Long Beach, is in the Museum of the Academy of Natural Sciences of Philadelphia.—Rhoads, 1902.

Southern Blackfish. *Globicephala brachyptera* Cope.

1876. *Globiocephalus brachypterus* Cope, Proceedings of Academy of Natural Sciences of Philadelphia, p. 129.

Type locality.—Delaware Bay, Maurice River Cove, N. J.

Faunal distribution.—Southeastern Atlantic Ocean, from N. J. to the West Indies.

Distribution in Pa. and N. J.—Delaware Bay; along the southern N. J. coast, northward, possibly to Sandy Hook, where it would overlap the southern range of *G. melas*.

Habits, etc.—So far as known, the southern blackfish behaves like its northern kinsman. It is distinguished by the relatively broader, shorter skull, resembling *G. scammoni* of the Pacific seas. The dorsal fin is much nearer the head than in *scammoni*. The pectoral fins are shorter and the teeth fewer, while the premaxillar bones are wider and the animal is without any white markings, being solid black. The length is 15 to 18 feet.

Records in Pa. and N. J., Cape May Co.—Hereford Inlet, recorded July, 1891.—True, 1902.

Cumberland Co.—"A female of this genus was taken by fishermen in February of the present year [1876] at the mouth of Maurice River, and was sent to this city [Philadelphia] where it fell under my observation."—Cope, sup. cit. A previous specimen, a skull, from the west shore of Delaware Bay (in Delaware) was recorded by Cope in 1866.—See P. A. N. S., 1866, p. 7.

Genus *Orcinus* Fitzinger, Wissen. — Populare Naturgeschichte. Saugethiere, 1860, vol. 6, pp. 204–217.

White-bellied Killer. *Orcinus orca* (Linnæus).

1758. *Delphinus orca* Linnæus Systema Naturæ, vol. 1, p. 77.

1899. *Orcinus orca* Palmer, Proceedings Biological Society, Washington, vol. 13, p. 24.

Type locality.—Coast of Europe.

Faunal distribution.—Found in all seas. Probably most abundant in subarctic and temperate waters.

Distribution in Pa. and N. J.—Along the New Jersey coast.

Habits, etc.—The notorious killer whale, the only cannibal of its order, combines enormous strength and ferocity with a comparatively small size as contrasted with that of the 100 foot whales which they hunt and destroy like packs of wolves. Their length is about 20 feet, though often longer; their jaws are wide and set with about 24 very large, stout teeth with conical recurved crowns and large roots, very unlike those of the rest of the *Delphinidæ*. The back-fin is like a sharp-pointed dagger, of great length, and set almost at right angles to the body. It has erroneously been thought by some a weapon of offense and destruction in "ripping" whales. Scammon calls them "wolves of the ocean" in their manner of worrying the largest whales, in packs. They also seize dead whales which are being towed ashore by whalemen and quickly descend with them into the deep beyond recovery. They are the only whales which eat mammalia, not only devouring the largest fish, but seals and all other dolphins, porpoises, and large whales are the main objects of their gluttonous rapine. Though the old walrus is safe from them, the young are greedily eaten. When they seek safety on the parent's back, the killer dives and rams its nose against the dam, throwing off the calf and seizing it in a twinkling. From the maw of one of these killers Eschricht states that 13 porpoises and 14 seals were extracted. This was an Atlantic *Orcinus* only 16 feet long. They are the terror of all dolphins, driving whole schools of these and of fish upon the sand of our bays. The color is black above, white beneath, a patch of white behind eye and on back near fin.

Records in N. J.—While often found off the N. J. coast there seem to be no records of its stranding or being captured. I have seen them in packs of 4 or 6 slowly trailing near the surface with the high dorsal fin standing straight out of the water a distance of nearly 2 feet. This on the coast near Beach Haven, N. J., and also near Atlantic City. It is thought by bathers to be a shark. I have not heard of their being man-eaters.—Rhoads, 1902.

Order UNGULATA; Hoofed Mammals.

Family CERVIDÆ—Deer.

Genus *Odocoileus* Rafinesque, Atlantic Journal, 1832, vol. 1, p. 109.

Virginia Deer. *Odocolieus americanus* (Erxleben).

1777. [*Cervus dama*] *americanus* Erxleben, Systema Regni. Animal, vol. 1, p. 312.

1899. *Odocoileus americanus* Miller, Bulletin N. York State Museum, vol. 6, p. 299.

Type locality.—Eastern Virginia.

Faunal distribution.—Lowlands, east of the Mississippi, from southern New York and Michigan to South Carolina and Louisiana.

Distribution in Pa. and N. J.—Originally abounding in all situations comprised in the lower Transition and Upper Austral life zones, now confined in its typical form to limited areas in southern N. J.; the deer yet found in Pennsylvania being practically restricted to the Canadian form, *Odocoileus americanus borealis.*

Records in Pa.—As above stated, the typical Virginia deer once found in the valleys and lowlands of the Susquehanna, Allegheny, Monongahela and Delaware river regions is exterminated. The nearest approach to this type of deer in Pa. may yet be found in the Pocono and South Mountain regions, for records of which see under *O. a. borealis.*

Records in N. J., Atlantic Co.—"I was born in Atlantic County and lived there more than 20 years. The southern part of Atlantic County and the northern part of Cape May Co. are still famous places for deer. I have known of three or four being killed there every year that the law permits. As far as I have been able to judge from my travels through the southern part of the state, the Virginia deer is practically confined to those 2 counties. It seems most abundant along the Great Egg Harbor River, in the neighborhood of Tuckahoe, Estelville, May's Landing and English Creek. Hunters from all other parts of south Jersey come there to hunt for deer."—Prof. Gifford in letter dated Feb. 4, 1901. A doe with 2 fawns was chased into the village of Mary's Landing in the summer of 1893 and killed herself by being impaled on an iron fence.—Gifford. Regularly hunted and killed in Atlantic Co. Rarely driven north of the W. Jersey and Seashore R. R.—Price. About 18 or 20 deer were killed this season [Fall 1901], mostly between "Head of Tuckahoe Riv. and Milmay and Egg Harbor City. They are hunted with dogs exclusively. Weather being dry many were started and lost. The 3 years close season was a great benefit."—Hand.

Burlington Co.—"Zebulon Collins used to trap deer on 'The Plains.' About as late as 1873 to 1875 deer were plenty on the east and west 'Plains' in the lower part of Burl. Co. Half Way and Cedar Bridge were headquarters for hunts. The old hunters with me were Judge Burr, of Vincentown, Miller Howard and Theodore Creamer, old residents of 'The Plains,' also Zeb. Collins, Jos. Adams and Nick. Levy, all dead before this."—Coffin (extract from letters written in 1893 to Rhoads). "I saw a drove of 12, two full antlered bucks among them, in 1878, at White Oak Cripple in Cumb. Co. and this year I hunted for 2 days with John Pim for a guide and did not find a trace or track. The woodchoppers . . . kill deer in June. No law can restrict them. I saw two heads bought by a peddler in August, sold to and mounted by a Trenton dealer. I saw no deer that had been killed [this season] and heard of but three. I regard the story of 14 shot in Atlantic Co. as a tavern keeper's yarn. I don't believe there are 50 deer in the counties of Cumberland and Cape May."—James Levy, of Phila. (extracts from an interview published in the Phila. Times, Dec., 1894).

Cape May Co.—"The big pines around Tuckahoe used to be a sure find, but I have not heard of one being seen there this year."—Levy, supra. (1894.) "Attempts were made to [preserve] the deer and one of the last parks to remain was that of Daniel Ludlam, of Dennisville, which was maintained until well into the present century."—Lee, historic account.

Monmouth Co.—"Charles O'Hogen killed a buck deer, the first deer that has been killed in Monmouth Co. in many years. The buck was tracked early this morning (Nov. 10, 1896) on the outskirts of the Oceanville roads and was shot at twice by gunners who sighted it in the Oceanville swamps. The shots frightened the deer and he crossed the Solomon Maps pond and ran to Oakhurst." O'Hogen shot the buck as it came running down the main street of Oakhurst, passing within 10 feet of where he chanced to be standing with a shot-gun in his hand. See Phila. Times, Nov. 11, 1896.

Southern N. J. in general.—Deer range over lower half of Ocean and upper portion of Atlantic Cos.—Pharo. Some remain in Burlington, Atlantic, Cape May and Ocean Cos. Two only known to be killed in Burl. and Ocean Cos. in 1898 out of 22 killed in South Jersey. Season closed from 1898 to 1901.—Van Note. Still found in upper Cape May Co. Also in Cumberland and Atlantic Cos. Between 20 and 25 were killed in the fall of 1898.—Hand. In Monmouth, Burlington, Cumberland and Cape May Counties (these then included Ocean and Atlantic Cos.) "multitudes are killed. Ten or twelve are sometimes started in a single drive."—See Doughty's Cabinet of N. History, 1832. Several were killed in the Tuckahoe region in fall of 1901.—Rhoads.

Historical notes furnished by F. B. Lee.—In Samuel Smith's Hist. Novo Cæsarea, 1765, p. 502 *et seq.*, deer are recorded as *very* plentiful, generally

bringing forth 2 fawns at a time, and "great numbers are destroyed by traps and hunting, by panthers, wild cats and sometimes wolves." Smith deprecates the use of the "enormous iron trap" for deer, their "enormous wide jaws of destruction being abhorrent to the common principles of humanity." Laws were ineffectually directed against these and also against "the practice of setting sharp stakes and loaded guns . . . common nuisances to mankind." In 1758, Cape May Co., though sparsely populated, was stated in Jacob Spicer's diary to have a trade in deer skins and venison hams worth 120 pounds sterling. The early colonists, unable to secure cattle, endeavored to domesticate deer for a supply of milk, but without success. In 1771 deer were becoming scarce enough to claim the attention of the lawmakers. An act was passed Dec. 21st providing that if any one "shall kill destroy or take any Roe Buck, Fawn or any sorts of Deere" between January 1 and September 1, he was to pay 40 shillings. Hunting on the Colony's unimproved land was limited to voters for Representatives in the General Assembly or their sons being 18 years of age. Traps were limited in size to those set for foxes. Penalties were named for the setting of a loaded gun and for watching for deer at night near a road. In 1772 an act was passed specially preserving the deer of Morris County, particularly those remaining in Great Swamp.

Habits, description of species, etc.—See next species.

Northern Virginia Deer. *Odocoileus americanus borealis* Miller.

1900. *Odocoileus americanus borealis* Miller, Bulletin N. York State Museum, Vol. 8, p. 83.

Type locality.—Bucksport, Maine.

Faunal distribution.—Canadian zone of eastern N. America.

Distribution in Pa. and N. J.—Once abounding, but now sparsely scattered or locally exterminated, in the upper Transition and lower Canadian life zones. Now found, if ever, in New Jersey, as a straggler only. Probably most numerous in the Pocono and South Mountain regions.

Records in Pa.—Adams Co.—"In fall and winter of 1892, 32 deer were killed legitimately within a radius of 10 miles among the Adams and Franklin Co. Mountains. In 1895 over 50 were taken, and probably as many more by pot-hunters and dogs out of season. In the fall of 1896 fifteen were killed between Graefensburg, Buchanan's Valley and Pine Grove in Cumberland Co., in the South Mountain region."—Strealy.

Cambria Co.—"A few remain."—Shields, 1901.

Carbon Co.—Stray into Wilkesbarre Mtn., Luzerne Co., from Pine Swamp, Kidder Twp., and headwaters of Lehigh in Coolbaugh and Tobyhanna Twps., Monroe Co.; 28 killed in 1898.—Stocker.

Centre Co.—Fairly abundant in Centre Co.—Fernald, 1900.

Clinton Co.—"Increasing here. I have heard of 20 being killed this fall (1900) in this Co."—Pfoutz. Gradually decreasing in numbers, but by their tracks in the mountains north of Round Island would estimate that 10 or 15 range over three square miles in that vicinity. An adult buck and doe and two yearlings were seen separately in various tramps covering a period of one week in the range in the fall of 1898.—Rhoads. I killed 23 deer in the fall season of 1873 (in the vicinity of Round Island).—Nelson.

Columbia Co.—A few killed yearly north of Fishing Creek in the North Mountain.—Buckalew, 1900.

Crawford Co.—Exterminated in this Co., save possibly in Sparta Twp. None killed in 1898.—Kirkpatrick.

Cumberland Co.—See under Adams Co., l. c.

Elk Co.—Not over 24 captured in 1898. Much scattered.—Luhr.

Forest Co.—Numerous. Ten killed near Tionesta in November, 1898.—Zendle. Fifty killed in Forest Co. in winter of 1898–'9.—Haslet. Heard of 20 killed in the Co. in the winter of 1898–'9. From 500 to 600 were commonly killed yearly between 1868 and 1878.—Irwin.

Franklin Co.—See above, under Adams Co.

Fulton Co.—Licking Creek township was considered one of the best hunting grounds for deer by the hunters of Fulton, Huntingdon and Bedford Counties in 1896.—Ingersoll, 1896.

Huntingdon Co.—Found near Mt. Union in 1896.—Ingersoll.

Lackawanna Co.—About exterminated.—Friant, 1900.

Lancaster Co.—One was captured in the borough (now city) of Columbia in 1831.—See Doughty's Cab. Nat. Hist., 1832, vol. 1, p. 285.

Luzerne Co.—Five brought to Pittston in fall of 1899. Most often found in the North Mountain region.—Campbell.—See also under Carbon Co.

Lycoming Co.—Have increased in the last 3 years (1896 to 1898) in the Loyalsock Creek grounds.—Parker, 1899.

McKean Co.—I know of only 4 being killed during the winter of 1900–'01 near Colegrove.—Dickeson.

Mifflin Co.—I hunted in Mifflin Co. the winter of 1898 and knew of 8 killed there.—Cleveland.

Monroe Co.—Present range in N. W. Twps. of our Co.; 4 killed in 1898.—Bisbing. See also under Carbon Co.

Pike Co.—Numerous in Pike Co. About 30 killed there in 1898.—Friant. The Co. (Milford) newspaper published a list of the deer killed in 1893 numbering 140.—See Rhoads in Proc. A. N. Sci., 1894, p. 388. Pike Co. harbors most of the deer of northeastern Pa. From 25 to 40 killed there in the fall of 1898.—Stevens.

Potter Co.—Some remain; very few killed in 1898.—Austin.

Somerset Co.—Scarce. No knowledge of any killed in Co. last season, 1898.—Moore.

Sullivan Co.—Range all over this Co., but quite rare now (1900). Heard of 6 or 8 killed in this and Wyoming Cos. this season; 15 would probably include all taken. A buck was sent to the Academy of Natural Sciences from here, shot 2 miles east of Ricketts' near Wyoming Co. line in 1891.—Behr, 1902.

Tioga Co.—Very few left in Tioga Co.—Babcock. Hunters killed three in the Canton region in 1898.—Cleveland.

Union Co.—Increasing in the Allegheny Mts. of the northwest border. Several killed in 1898.—Chambers.

Venango Co.—"As many here in 1900 as there were 15 years ago. Many more than 7 years ago. Twenty-seven killed in 1897. Hounding not tolerated."—Dorworth, 1900.

Wayne Co.—Very scarce. A few remain along the Delaware River.—Kellew. Almost extinct.—Day.

Westmoreland Co.—Practically exterminated. None killed for several years.—Rhoads, 1899.

Wyoming Co.—A few left; only 2 killed in fall 1900.—Robinson. Range in S. W. part of Co.—Behr. Mehoopany Creek is their haunt.—Campbell. See above under Sullivan Co.

Records in N. J.—Sussex Co.—Long since exterminated in northern N. J., but occasionally driven across the Delaware into Sussex Co. from Pike Co. by dogs and hunters. I know of no recent records of this, however.—Rhoads, See Proc. A. N. Sci., 1897, p. 25.

Warren Co.—"Occasionally seen in the mountains near the Water Gap."—Davison, 1902. Some deer straggle into the mountains and rarely shot.—Strickland, 1902.

Habits, etc.—The following brief notes regarding the northern deer as seen in Clinton Co., Pa., were given by Seth Nelson of Round Island.

The largest number of points ever known to him on one buck's horn was 11, 21 in all. The heaviest bucks weigh 200 lbs. dressed, their offal weighing 50 lbs., the average buck weighing 125 lbs. dressed, and the average doe 80 lbs. Does have fawns in May, rut about October 1st. Some velvet may remain on buck-horns in October. The does oftener have 2 than 1 fawn, sometimes 3. They go to a thick windfall to drop young. Fawns are weaned in 4 months or before the rutting season. They stay hid where calved 2 or 3 weeks. Twin fawns stay together all their first winter. More does than bucks are born. In the rutting season 1 buck may control 5 does, mostly 3. He shot one doe with spike horns 2 inches long. In spring deer feed on wintergreen, tree mosses, partridge berry, buds of trees and bushes,

ALLEGHENIAN WAPITI OR ELK (*Cervus Canadensis*).

Photo from Audubon's Painting of Living Pennsylvania Specimens.

"red root," a broad-leaved grass and tender lichen and ferns. In the fall, buckberry, chestnuts, acorns, beech-nuts and rhododendron form the bulk of their food. In winter, on dead oak leaves, buds, sweet fern. When the snow crusts they gather in herds and make paths in high laurel and thick hemlock timber.

Description of species.—The northeastern deer is a larger animal than the Virginia deer, with heavier, coarser horns and teeth, and showing a great contrast between the "red" summer and "gray" winter coats. In the southern deer the summer and winter coats are not so contrasted, always retaining the reddish cast. No measurements are now available that would give a proper idea of the average differences in size.

Genus *Cervus* Linnæus, Systema Naturæ, 1758, vol. 1, p. 66.

Eastern Wapiti, or "Elk." *Cervus canadensis* (Erxleben).

1777. [*Cervus elaphus*] *canadensis* Erxleben, Syst. Regn. Anim., Vol. 1, p. 305.

1822. *Cervus canadensis* Desmarest, Mammalogie, Vol. 2, p. 433.

Type locality.—Eastern Canada.

Faunal distribution.—Canadian and Transition zones, sometimes descending into the Upper Austral.

Distribution in Pa. and N. J.—Numerous up to the beginning of the 19th century in the entire Pa. Alleghenian mountain system east of the Allegheny River; rare in the Blue Ridge and Cumberland ranges; once numerous on the Pocono plateau. Driven occasionally by stress of weather, beasts of prey and man into the lowlands of the southern Allegheny, Susquehanna and Delaware River valleys, and the highlands of northern New Jersey, where, in early historic times, it may have voluntarily made its habitat at certain seasons. Now extinct in our limits. Numerous localities in Pennsylvania bearing the name of "Elk" in various combinations, indicate that it was formerly known either as an abundant resident or as a straggler in nearly every part of the state. Its remains show that it was formerly found in the Delaware Valley as far south as Bucks Co.* in Penna., and Mercer Co. in N. J., during the existence there of aboriginal man. (See list of fossil species.)

Habits, etc.—The favorite haunts of the Alleghenian wapiti in Pennsylvania were the forest-covered mountain elevations where open glades or savannas and old beaver meadows were surrounded by the primeval forest. Where these features were combined in the vicinity of a "lick" or saline spring the

* The Durham Cave, Riegelsville, Bucks Co. remains are probably recent, but may have belonged more properly to Postpliocene age.

greatest numbers of these animals congregated, and it was in such localities that the last representatives of this noble deer vainly sought to escape their final destruction. From accounts received from numerous correspondents it appears that the "Flag Swamp," situated in the eastern part of Elk Co., near the Cameron Co. line, and forming one of the headwaters of Bennett's Branch of the Susquehanna on the east and of a branch of the Clarion River on the west, was the last refuge of the wapiti in Pennsylvania. A few are recorded as living there in 1850 in a History of Elk County of that date. Between the dates of 1860 and 1867 I have secured records of the capture of two or three which are each claimed to be the last taken in the state. To one of these undoubtedly that distinction belongs, so far as can be discovered. The one recorded by Roosevelt for 1869 is the same as the one stated by Capt. Clay to have been killed in 1866 (see records). It is probably the same as the one stated in the Utica Globe article to have been killed by an Indian in 1867, and in the History of Elk Co. the same date is given for its extinction in that county, reference no doubt being made to the same individual. This "Flag Swamp Elk," taken in November, 1867, in Elk Co., by an Indian of the Cattaraugus reservation named Jim Jacobs, appears to have been the last of its race in the Allegheny Mountains, unless it shall be proved that some existed later in the mountain wilds of West Virginia. In the northeastern Alleghenies of Sullivan, Luzerne and Wyoming counties they seem to have totally disappeared in the second decade of the 19th century, although a few remained in a favorite haunt called "Elk Forest" in the Pocono range of Wayne Co. until exterminated between 1830 and '40. In Tioga, Lycoming and Potter counties they haunted the headwaters of Pine Creek and the Black Forest until 1862, when the last was killed. The veteran pioneer, Mr. Austin, saw their tracks as late as 1857 in Potter Co., and near the same time a party of hunters captured 3 alive in Tioga Co. In Somerset and Bedford counties, where the mountain glades and saline or sulphur springs were sought out by numerous bands of wapiti and buffalo in early colonial times, their extermination must have been of very early date, as records of them in these localities seem to rest upon place-names and tradition. (See note under Somerset Co.) Even more obscure is the evidence of their former occurrence in the southwestern counties of Pennsylvania, and in the parts of New Jersey pertaining to the valley of the upper Delaware. Elk View, Elk Mills and Elk Creek in Chester Co., and Elk River in Maryland, are names whose origin I have not satisfactorily traced, but indicate the former presence of this animal nearer the Atlantic seaboard than anywhere else in the United States. From our knowledge of the partiality of the wapiti to mountain districts it is very unlikely that it ever resided permanently in Chester Co. Kalm and one or two historians of the seventeenth and eighteenth centuries record them in southeastern Penna., and Kalm relates how the "stags" (as distinguished

from the common deer) were driven down from the mountains into the vicinity of Philadelphia and killed in great numbers because of a great snow. Such lowland invasions probably account for the place-names we have mentioned as well as for the remains of this animal in camp and village sites of the aborigines on both sides of the Delaware as far south as Trenton. Not only would the rigors of winter drive them from their mountain fastnesses, but the increased persecutions from the starving wolves and of the Indians, and the freezing of the Susquehanna and Delaware Rivers, would induce the stricken creatures to scatter over areas hitherto unknown to them. It is likely that at no time during man's existence in New Jersey was the wapiti a voluntary resident of that state even in the Kittatinny range, which is the natural continuation of their ancient haunts in the Blue Ridge and in its northern section was in easy reach of a hunted wapiti from the Pocono region seeking to throw its pursuers off the scent in the waters of the Delaware. Only as a straggler, therefore, can the wapiti be considered a member of the historic fauna of New Jersey. It should be borne in mind, however, that the accounts of earliest historians, coupled with our knowledge of the wapiti in the far west, indicate that this species may have roamed at will in pre-Columbian times over almost the entire region included in this paper.

Regarding the habits and food of the wapiti it may be stated that they are similar to those of the Virginia deer in most respects. They are, however, more addicted to keeping in companies throughout the year and, like the moose, "yard up" during the season of deep winter snows. The males cast their horns in February and March and by the month of August they are again renewed in all their perfection. They make a loud whistling snort when alarmed, and during the rutting season the bucks utter a loud note of defiance which Godman says resembles both the neighing of a stallion and the bellowing of a bull. Caton says it sounds like the whistle of a locomotive. The young females give birth in May or June to one fawn, the older ones generally two, and rarely three. When wounded, the wapiti is more ready to turn on its pursuers than a deer. In flight they pursue a straight course and will sometimes outstrip the chase of the most enduring hunter and hounds for two or three successive days.

When deprived of their usual winter browse of elk grass and brake by deep snow they subsist for months on the buds and branches of such trees as they would not touch in summer, and when a crusted snow prevents them from going outside their yards for water they do without it for a long period.

Among the favorite trees which they seek to eat in summer is one called by hunters the elkwood.* This they attack, not only devouring the leaves

* Also called the moose tree. It is the *Acer spicatum*, a dwarf species of maple growing about fifteen feet high in the forests.

and twigs but denuding it of bark. By this means their whereabouts are easily detected, the peeled saplings forming a conspicuous "sign" for the hunter. Basswood is also much sought after, but very few deciduous trees come amiss at any season, the elk being a most omnivorous and hearty feeder.

Audubon in the book "Quadrupeds of North America," thus speaks of a pair which he had in captivity (Vol. 2, 1851, p. 90): "The pair from which the figures on our plate were taken we purchased at Philadelphia. They had been caught when young in the western part of Pennsylvania. The male was supposed to be four or five years old and the female also was full grown. . . They often whistled (as the hunters call this remarkable noise) which in calm weather can be heard nearly a mile. This shrill sound appears to be produced by an almost spasmodic effort, during which the animal throws its head upwards and then backwards." Audubon further speaks of their gregarious habits, congregating to the number of 50 to 100 in a herd under one master buck, whose movements are closely followed by the whole band, whether in flight or on the watch; easily domesticated and living to a great age, even 25 or 30 years in captivity; lying down in midday and feeding before sunrise and after sunset. Caton, who had a large number in captivity, and hunted them in the west, gives an account of them in his book on American Deer, from which the following points may be summarized: The fawn is spotted as in the common deer: in wild, undisturbed country not a nocturnal feeder; more polygamous than any other deer except the Red deer of Europe; master deer of the herd nearly always dangerous in captivity, a perfect tyrant during the rutting season, and at all times supremely selfish and abusive; does more courageous than bucks against a wild enemy, giving chase in a body and striking with forefeet, the bucks following at a distance; better adapted to domestication than any other deer; more healthy and hearty feeders, eating fodder a cow or horse will reject; young feign death, when picked up, lying limp; follow dam in 2 days after birth, unusually precocious in this respect as compared with other deer; wallowing in summer like the bison; natural gait a trot, very rapid and continued when pursued; when closely pressed into a run soon become exhausted; in their natural freedom inhabiting all kinds of country contiguous to woodland or forested, whether mountain or plain, ranging from above timberline 10,000 to 12,000 ft. to the sea level, but preferring mountainous regions, from which they never stray a great distance unless from hunger or enemies; not as tenacious of life as deer, an ordinary shot soon disabling or killing them; hide of little economic value, being soft and pliable as in other deer similarly tanned, but of little strength and durability; meat much esteemed; horns used by the Indians as bows; canine or fang teeth of males used as a valued ornament or charm.

The following notes by my valued correspondent, Mr. E. O. Austin, of Potter Co., Pa., regarding the habits of the wapiti in that county are of much

interest. Under date of March 4th, 1901, he writes: "I settled at my present residence, now in the borough of Austin, in 1856, then a perfect wilderness. When I came into this region, a young man, I could not be surfeited with the stories told by old settlers and hunters as to what they had seen. On the First Fork of the Sinnemahoning near Prouty Run [Potter Co.] was the 'Great Elk Lick' of this region. About 1835 or '36 the first settlers came into this region. The Elk with other wild creatures then reigned here in their glory. Clifford Haskins, Charles Wykoff, the Jordans, and John Glasspy, with others, were among the prominent men of the time. They were all settled within three or four miles of this lick. They all told me that they would go to the Elk-lick to get a deer as often as they wanted one in the summer time. Here sometimes 50 or more could be seen at a time, with the fawns playing around like young lambs. Cliff. Hoskins said he went there once to get a deer when he saw several Elk in the lick and more in the clearing around it. It being the first time he had seen Elk there he gazed in wonder, when more came in until 40 or 50 had congregated. He watched their grim play for some time and then shot one. The rest started back, then stamped around their fallen comrade gazing in a bewildered way, and stampeded with the noise of thunder when Hoskins approached. Aunt Eleanor Wyckoff lived a mile and a half from Elk Lick. She told me she thought her brother, Mr. Jordan, was telling one of his big yarns when he told her of a similar view of Elks, but one day after, when the men found they were around again, she went with her husband to see them. She said 'First some came, then more, until the clearing seemed full of them and the men said there were about 50 there.' Regarding the *clearing* above mentioned—where the elk frequented a big lick they rubbed their horns against the trees, sometimes in play or to rub off the velvet or skin from the new horns. This process soon kills all the trees except some big old ones, so that a clearing of 2, 3 or 4 acres is made around the lick. A few thorn trees [*Cratægus*] come up on it which grow so low and stout as to defy them, when it is called a 'Thorn Bottom.' The elk are gregarious, living in small herds if unmolested, likely in families, but they congregate at the licks in summer in considerable heads.

"I have no account of their 'yarding' in this county. Their food in summer was nettles [*Laportia*], elk or cow cabbage, elk grass [a wide-bladed bunch-grass common to the woods], and the tender growing twigs of most deciduous trees; and in the winter this elk grass, which keeps green all winter, the edible brake or cow brake [*Pteris aquilina*] or fern, and browse of deciduous trees. They migrate in families from section to section of the country, much like deer, but farther away.

"John Glasspy told me of taking a contract to catch elk alive for some fancier. They find and single out their elk, when two men with a small dog, and each a coil of rope and well filled knapsack of grub, start on the chase,

and a long chase it is. But after three or four days the creature halts to see what is following him. They then let loose the little dog. The elk seems to wonder if he has been frightened by that little whiffet. The men have chosen their time and place not far from some rocky ridge or large rock, accessible to the elk. The dog attacks him with a great noise, and not much else. The beast runs for a rock as the best fort of defense from the attack. While his attention is absorbled by the antics of the little dog, it is easy to put a rope over his horn with a long pole, or by throwing it noosed, and with two ropes on his horns and two strong men, wide apart, to hold him, he soon becomes tired and docile enough to be led out and home. This was not an unfrequent occurrence in those times."

The following article was published in the "New York Times" and reproduced in the "Pittsburg Post" of April 19th, 1896:—

"When I started in to amuse and profit myself by following the chase in northern Pennsylvania," said Colonel Parker, of Gardeau, Pa., "elks were running in these woods in herds. I have killed elk a-plenty in the Rocky Mountain country and other regions since, but I never ran across any that were as big as those of old-time Pennsylvania elk. I have killed elk on the Sinnemahoning and Pine creek waters, and down on the Clarion river and West branch, that were as big as horses. A 1000-pound elk was nothing uncommon in that country, and I killed one once that weighed 1200 pounds. These were bulls. The cows would weigh anywhere from 600 to 800 pounds.

"The Pennsylvania elk's eyes were small, but sparkled like jewels. I have often seen a score or more pairs of these bright eyes shining in the dark recesses of the pine forest, when the shadows might have otherwise obscured the presence there of the owners of those tell-tale orbs. An infuriated bull elk's eye was about as fearful a thing to look at as anything well imaginable, but so quickly changeable was the nature of these huge beasts that two hours after having captured with ropes, one that had, from the vantage ground of his rock, gored and trampled the life out of a half dozen of dogs, and well-nigh overcome the attacking hunters, submitted to being harnessed to an improvised sled and unresistingly hauled a load of venison upon it six miles through the woods to my cabin, and took its place among the cattle with as docile an air as if it had been born and brought up among them.

"The elk that Sterling Devins had mistaken for a mule, he and Ezra Prichard followed all the next day, but lost its trail. Some Pine Creek hunters got on its trail, drove it to its rock, and roped it. When Devins and Prichard got back at night they found the Pine Creek hunters there and the elk in the barn eating hay and entirely at home. That elk had quite an interesting subsequent history. Ezra Prichard had, previous to the capture of this one secured a pair of elks, broke them, and for a long time drove them to farm work like a yoke of oxen. Sterling Devins was eager for a yoke of elk, and

he offered the Pine Creek hunters $100 for the one they had captured. They refused the offer, but afterwards got into a dispute about its ownership, and it was sold to Bill Stowell and John Sloanmaker, of Jersey Shore. These men took the elk about the country, exhibiting it, and made quite a sum of money. Next fall, although the elk was a cow, it became very ugly and attacked its keeper, nearly killing him before he could get away. No one could go near her, and her owners ordered her shot. The carcass was bought by a man who had a fine pair of elk horns. He was a skillful taxidermist, and he managed to fasten the horns to the head of the cow elk in such a manner that no one was ever able to tell that they hadn't grown there. This made of the head an apparently magnificent head of a bull elk, and it was purchased for $100 on that belief, by a future governor of Pennsylvania.

"That cow elk was one of the last family of elk in the Pine creek country [Potter Co.]. She and the bull and calf had been discovered some time before Sterling Devins ran across the cow, by Leroy Lyman, on Tomer's run, near the Ole Bull settlement [Abbot township]. Lyman got a shot at the bull, but the whole three escaped. The same party of hunters that captured the cow killed the bull afterward in the woods on Kettle creek. The calf the dogs ran into Stowell's mill pond, and there it was killed.

"A set of elk antlers of five feet spread and weighing from forty to fifty pounds, was not an infrequent trophy. George Rae, who was one of the great hunters of northern Pennsylvania in his day—and he is one of the greatest in the Rocky Mountains even to this day, in spite of his eighty-five years—lived along the Allegheny at Portville. He had in his house and in his barn, the walls almost covered with the antlers of elk he had killed, on the peak of his roof, at one end, being one that measured nearly six feet between the extremities. When George moved West forty years ago he left the horns on the buildings, and only a few years ago many of them were still there, as reminders of what game once roamed our woods.

"It required more skill to hunt the elk than it did to trail the deer, as they were much more cautious and alert. For all that, an elk, when started from his bed, did not instantly dash away, like the deer, but invariably looked to see what had aroused him. Then, if he thought the cause boded him no good, away he went, not leaping over the brush, like the deer, but, with his head thrown back, and his great horns almost covering his body, plunging through the thickets, his big hoofs clattering together like castanets as he went. The elk did not go at a galloping gait, but traveled at a swinging trot that carried him along at amazing speed. He never stopped until he had crossed water, when his instinct seemed to tell him that the scent of his trail was broken before the pursuing dogs.

"At the rutting season the elk, both male and female, were fearless and fierce, and it behooved the hunter to be watchful. An elk surprised at this

season did not wait for any overt act on the part of an enemy, but was instantly aggressive. One blow from an elk's foot would kill a wolf or a dog, and I have more than once been forced to elude an elk by running around trees, jumping from one to another before the bulky beast, unable to make the turns quick enough, could recover himself and follow me too closely to prevent it, thus making my way by degrees to a safe refuge. I was once treed by a bull elk not half a mile from home and kept there from noon until night began to fall. I haven't the least doubt but he would have kept me there all night if another bull hadn't bugled a challenge from a neighboring hill and my bull hurried away in answer to it.

"The whistle of the bull elk, as the hunters call it, wasn't a whistle, although there were changes in it that gave it something of a flute-like sound. The sound was more like the notes of a bugle. In making it the bull threw back his head, swelled his throat and neck to enormous size, and with that as a bellows he blew from his open mouth the sound that made at once his challenge or call for a mate. The sound was far-reaching, and heard at a distance was weird and uncanny, yet not unmusical. Near-by, it was rasping and harsh, with the whistling notes prominent.

"The Pennsylvania elk was never much scattered. When I first came to the Sinnemahoning country, nearly seventy years ago, the salt marsh that lay in the wilderness where my residence now is [Gardeau, in the extreme S. E. corner of McKean Co., almost on Potter Co. line], was trampled over by herds of elk and deer that came there to lick the salt from the ground as if a drove of cattle had been there. I have seen seventy-five elk huddled at that marsh. That was the 'Big Elk Lick' of legend which the reservation [Cornplanter] Indians had often talked to me about when I lived in Allegheny county, New York, as a boy, and it was to find that lick that my father and I, following the rather indefinite directions of one Johnnyhocks, an old Shongo Indian, entered the Pennsylvania wilderness in 1826. The marsh is now the site of a big hotel, it having been found that the depth of the swamp concealed waters [Parker's Springs] of rare medical value.

"To follow an elk forty miles before running it down was considered nothing remarkable. I have done it many a time. Leroy Lyman, Jack Lyman and A. H. Goodsell once started on an elk hunt from Roulette, Potter county, struck the trail at the head of West creek in McKean county, thirty miles from Roulette, followed it through Elk, Clarion and Clearfield counties, and finally drove it to its rock eighty or ninety miles from where the trail was first struck. They had followed the elk many days, and finally the quarry was found, an enormous bull with a spread of horns like a young maple tree. The horns were the only trophy that the hunters got from the long and tedious chase [meat being unfit to eat], and that trophy was well worth it. It was the largest and next to the finest pair of antlers ever carried by an elk in the Pennsylvania forests, so far as there is any record.

"There are scattered through the woods, generally high on the hills, from the Allegheny river down to the West branch and Clarion river, huge rocks, some detached boulders and others projections of ledges. These are known as elk rocks, and every one of them has been, in its day, the last resort of some elk brought to bay after a long and hard chase. It was the habit of the hunted elk, when it had in vain sought to throw the hunter and hound from the trail to make its stand at one of these rocks. Mounting it, and facing its foes, it fiercely fought off the assaults of the dogs by blows of his fore feet or tremendous kicks from its hind feet, until the hunter came up and ended the fight with his rifle. It would be strange if one or more of the dogs were not stretched dead at the foot of the rock by the time the hunter arrived on the scene. I have more than once found dead wolves lying about one of these elk rocks, telling mutely, but eloquently, the tragic story of the pursuit of the elk by the wolves, his coming to bay on the rock, the battle and the elk's victory. The elk was not always victor, though, in such battles with wolves, and I have frequently found the stripped skeleton of one lying among the skeletons of wolves he had killed before being himself vanquished by their savage and hungry fellows.

"In the winter time the elks would gather in large herds and their range would be exceedingly limited. Sometimes they would migrate to other regions, and would not be seen for months in their haunts, but suddenly they would return and be as plentiful as ever. They had their regular paths or runways, through the woods, and these invariably led to salt licks, of which there were many natural ones in northern Pennsylvania. One of the most frequented of these elk paths started in a dense forest, where the town of Ridgway, the county seat of Elk county, now stands, led to the great lick on the Sinnemahoning portage, and thence through the forest to another big lick, which to-day is covered by Washington Park, in the city of Bradford [McKean Co.]. I have followed that elk path its whole length, when the only sign of civilization was now and then a hunter's cabin, from the head-waters of the Clarion river to the Allegheny, in McKean county. Hundreds of elk were killed annually at the licks or while traveling to and from them, along their well-marked runways.

"The biggest set of elk antlers ever captured in the Pennsylvania woods was secured in the Kettle creek country by Major Isaac Lyman, Philip Tome, George Ayres, L. D. Spoffard and William Wattles. Philip Tome was a great hunter, and the famous interpreter for Cornplanter and Blacksnake, the great Indian chiefs. He came over from Warren county to help Major Lyman capture an elk alive, and the party started in on the first snow, with plenty of ropes and things. They camped, but the elk were in such big herds that they couldn't get a chance at a single bull for more than a week. Then they got the biggest one they ever saw and gave chase to him. They started him

from his bed on Yocum hill. The dogs took him down Little Kettle creek to Big Kettle, and up that two or three miles. There the elk came to bay on a rock. He kept the dogs at a distance until the hunters came up, when he left the rock and started away again. Tome, knowing the nature of elk, said that all they had to do was to wait and the elk would return to the rock. They dropped poles and fitted up nooses. They waited nearly half a day, and then they heard the bull coming crashing through the woods, down the mountain sides, the dogs in full cry. He mounted his rock again. The hunters he did not seem to mind, but the dogs he fought fiercely. While he was doing that the hunters got the nooses over his immense horns and anchored him to surrounding trees. They got the elk alive to the Allegheny river, and floated him on a raft to Olean Point. From there they traveled with him through New York State to Albany, exhibiting him with much profit, and at Albany he was sold for $500. That elk stood sixteen hands high and had antlers six feet long, and eleven points on each side, the usual number of points being nine on a side.

"The last elk in Pennsylvania is supposed to have been killed in the winter of 1867, by an Indian named Jim Jacobs, from the Cattaraugus reservation. Jacobs followed the elk from Flagg Swamp, in Elk county, to the wilds of Clarion county, through a hard snowstorm, where it came to bay on a rock, and the Indian shot it. It was a bull elk and none had been seen or heard in the region for several years before that."

I wrote Mr. E. O. Austin, of Austin, Potter Co., distant 7 miles from Gardeau as to his view of the narrative of Capt. Parker above quoted. He writes me that he knew Parker, Lyman, Pritchard, and others named, nearly all of whom, including Parker, are now dead. Sterling Devins still lives in Homer township, Potter Co. They all told substantially the same stories of elk habits as given by Parker, who was an old veteran, not only in age and hunting exploits, but in his latter days as a story teller. Mr. Austin writes: "What Col. Parker says of the *habits* of elk and other wild animals is very correct, but he was in the habit of making a good story of his exploits." A failing, I might add, which is common to so many "great, old men," that the world knows how to make allowance for it.—Rhoads, 1902.

Records in Pa.—Eastern Pa.—Kalm relates (Travels, 1781 ed., p. 199, vol. 2) that the "Stags" [wapiti] came down from the mountains [of Penna. and N. J.?] in 1705, and were killed in great numbers on account of a great snow. Gabriel Thomas (History of Pennsylvania and West New Jersey, (1698, p. 15), in the part devoted to Penna. speaks of the "red deer," "vulgarly called *stags*," one of which he bought for two gills of gunpowder. Farther on he states "there are vast numbers of other wild creatures [in Penna.], as elks, buffalos," etc. Regarding the name "Stag," McKay, in his Zoölogy of New York uses this as the common name for the wapiti.

Ord, in Guthrie's Geography (Amer. ed., 1815, p. 306), uses the same name for it. Godman uses both this name and "red deer" in his synonymy (Nat. Hist., vol. 2, p. 294). "Red deer" was used by the backwoodsmen to distinguish it from the Virginia or "wild deer," as G. Thomas calls them. The use of the term "Elks," by Thomas, seems to show that it was also used at that time to designate the wapiti. "Red deer" was probably given by the English to the wapiti on account of its resemblance to the deer of England *Cervus elaphas*. The name was also literally applicable to it on account of its color, as contrasted with that of the Virginia deer. Dr. B. S. Barton (Med. and Phys. Journal, 1806, p. 46), writes: "In the memory of many persons now living, the droves of elks which used to frequent the salines near the river Susquehanna in Pennsylvania [probably referring to eastern and central Penna.] were so great that for 5 or 6 miles leading to the licks the paths of these animals were as large as many of the great public roads of our country. Eighty elks have sometimes been seen in one herd upon their march to the salines."

Northwestern Pa.—I remember seeing 2 bull elk a man had captured alive in one of our northern (Penna.) counties, but have forgotten which one it was." . . "Regarding those two elk, I was a boy at a county fair in the early '70's, in Blairsville, Indiana Co. The man who owned the elk was there with them, and said he had walked them down in the deep snow when they were young. They were both bulls, and he drove them around the track in a buggy. . . . As I remember they were small-sized [specimens]. I was on a hunting trip in the west last fall, and saw hundreds of wild elk, so I am sure these were the genuine article." Shields, Jan. 11, 1901. "At present [1851] there is only a narrow range on the Allegheny mountains where the elk still exists [in Penna], . . . and these would undoubtedly migrate elsewhere were they not restricted by the extensive settlements on the west and south."—Aud. Bachm., Quad. N. Amer., vol. 2, p. 92. Audubon further states that Mr. Peale, of Philadelphia, told him about 1846 that the only place he could secure wapiti in the Atlantic States was on some barren mountains in northwestern Pennsylvania, where he had hunted them. The specimens figured in plate II. represent two Pennsylvania Elk which Audubon had in captivity in New York.

Allegheny Co.—Place-name Elkhorn, in southernmost township.

Cameron Co.—"Two of the old settlers who first settled on the Driftwood River, above Emporium, told me that during the thirties [1830 to 1840] they counted in one drove at one time seventy elk in and around the Big Lick, on the Driftwood. In 1839 my father killed one on the Driftwood about a mile from Big Elk Lick."—C. W. Dickinson. "Favorite places for them were Hick's Run and Driftwood River, this county."—Larrabee. See also notes under Elk Co.

Centre Co.—"The elk have all been exterminated in the vicinity of Pine Glen." They were here 30 years ago [1864?].—G. K. Boak. See Rep. Pa., Dept. Agric., 1896, p. 328.

Chester Co.—The following paragraph was written by a lifelong resident of Colora, Cecil Co., Maryland, in answer to my inquiries regarding the origin of the place names of Elk River, Elk Creek and Elkton in Md., with their repetition in Chester Co., Pa., as Elk township, Big and Little Elk Creek, Elk View and Elk Mills. It indicates how completely even the traditional origin of names given in the earliest settlement of the country has ceased to be handed down. Published local histories seem to be silent on the subject. As we have Kalm's evidence of the former appearance of elk in the vicinity of Philadelphia, and the record of their existence in the Susquehanna valley as far south as York (see York Co.), there is every reason to predict that, as historic evidence accumulates, we will not find it necessary to account for these place-names in Cecil and Chester Co. to the fancied resemblance of Elk River and its tributaries to the skull and antlers of an elk. The extract referred to reads: "After living here 60 years I have never heard of the elk-deer being found in these regions. I have always had the idea that our creek obtained that prefix from the circumstance of coming together in a common estuary as the horns of an elk to his skull. The creeks being thus named, the tidewater part, the bay, was called Elk River. Hence also the name of the town and railroad station."—Lloyd Balderston, 4–10–1901. I have recently made personal inquiry among the old residents of this region, and while there is no absolute proof of the former existence of elk there *now* known to them, it is the general opinion that such was the case. Certain old salt and sulphur springs are mentioned as forming a likely attraction.—Rhoads, 1902.

Clarion Co.—See place-name of Elk township and Elk City in the northwestern part of Co.

Clearfield Co.—"An elk was killed near the present site of Coalport by Mr. James Turner in 1837."—Abraham Neverling, see Rep. Pa. Dept. Agriculture, 1896, p. 328.

Clinton Co.—Between 1831 and 1837 I used to hunt them in this and adjoining counties.—Seth. I. Nelson.

Columbia Co.—Place-name of Elk Grove on extreme northern border.

Crawford Co.—A. Huidekoper includes the "elk" in the animal list in his "Sketch of Crawf. Co." (Mem. Penna. Hist. Soc., 1846). In a History of Crawf. Co. (1885, p. 260), we read, "Elk were rarely seen west of the Allegheny river," in that county.—Rhoads.

Elk Co.—"At the head of Bennett's Branch is a marsh, called Flag Swamp, remarkable as probably the only one in the state where the Beaver may be found [in 1850]; . . . in the same region a few Elk remain." . . . "Elk were found in Flag Swamp as late as 1850, and the last elk killed in Pennsyl-

vania was taken in 1867 on Bennett's Branch."—See Hist. Elk Co. (Chicago), 1890, pp. 573 and 578. "Colonel Cecil Clay informs me that an Indian whom he knew killed one in Pennsylvania in 1869."—Theodore Roosevelt, in Forum, Aug., 1893. "The last Elk that I know about was killed on Crooked Creek in this [Elk] county about 33 years ago [1866] by Cornplanter Indians from the N. York reservation." "These Indians killed one elk and took out the other alive (a buck) in the winter of 1866 or early in the spring of 1867. They captured the elk with muzzled dogs and by use of snow shoes. Crooked Creek rises at the foot of the ridge in Elk Co. that divides the waters of the Susquehanna and Clarion Rivers."—Cap. Clay. "Mr. Seth Nelson stated to me that one of the last elk known to have been killed in that region was secured on Bennett's Branch, Elk county, by a party of Cornplanter Indians about 1865. A hunter, Wilson Morrison, brought the carcass of an elk about that time to Lock Haven [in a boat] claiming that he killed it, but it was afterward understood that he paid $25 to the Indians for it."—See Rhoads Proc. A. N. Sci., 1897, p. 208. In regard to the Utica Globe article (see foot-note, supra cit.), Nelson has since informed me that the dates are very misleading. His father and Parmenter did not hunt this elk in 1867 as there stated but about 1835 or '36. The story of how the Indian, Jim Jacobs, outwitted them is correct. The elk was killed upon or near the site of the town of St. Mary's, then on "West," now Elk, Creek. When the railroad was graded through this region Flag Pond and Swamp were drained off. It consisted of "one acre of water surrounded widely by flags and willows." Possibly it was a salt or licking pond. This is almost certainly the same locality mentioned as being at the head of Bennett's Branch in the History of Elk Co., its waters flowing on one side into Trout Run of that Branch of the Susquehanna and on the other into Elk Creek, a tributary of the Clarion River. Nelson states this 1835 elk was started in Potter Co. and that it was by no means the "Last Elk of the Sinnemahoning," as stated in the newspaper, for while tracking it his father saw signs of several others.

"The last elk supposed to have been killed in Penna. was killed by Geo. Gaylord of Tioga Co., I think about 30 years ago."—W. C. Babcock, Oct., 1899. "I do not know the exact time that brother George [Gaylord] killed the elk, but it was soon after the Civil war. He sent the horns to a man in Philadelphia. He said that the horns had five prongs."—Mrs. J. H. Harmon, Wellsboro, Pa., Oct., 1899. A five-prong buck elk was killed by Geo. W. Gaylord of Farrandsville and James David of Beech Creek on Hick's Run of Bennett's Branch of the Sinnemahoning River, 25 miles from Driftwood, near the line between Elk and Cameron counties. It was boated down to Farrandsville, Clinton Co. Weight over 500 lbs. This was in the year 1862.—C. C. Pfoutz (in his first letter). In a later letter giving more exact information, Mr. Pfoutz reiterates the identity of the men, Gaylord and

David, says he often talked with Gaylord about this hunt and long knew him as a great hunter and, what is more rare, a *truthful* man! A friend of Gaylord's, George Dewey by name, lumbering in Elk Co. came to Farrandsville and told Gaylord of the elk. So Gaylord got his old hunting companion, David, to bring his dogs. This was "after the big spring or summer flood of 1862, as they had to walk all the way up the river to the mouth of Hick's Run of Bennett's Branch [owing to the absence of bridges and washing of roads preventing use of horses]." They staid all night at "cracker" Hick's cabin, who set them on the elk trail. They hunted all day and camped one night. The next day at 2 o'clock they started the elk, and in a few minutes it stood at bay and began fighting the dogs, when Gaylord came up and killed it. They hired a team and got it down to the creek, where they built a boat and brought it to Farrandsville by water. Pfoutz says he lived with or near Gaylord 16 years; thinks it was in November, 1862, that the hunt occurred, as he was in the Civil war at the time. He strongly denies the story that this elk was procured from Indians, as implied by Nelson in the following communication: "James David and Wilson Morrison were said to have killed an elk in Elk Co. in 1865. It was brought down the river in a boat. They did not kill it, but bought it of 3 indians." Cap. Clay thinks it possible this was the Cornplanter elk of 1866. The dates nearly coincide, and the Susquehanna was its natural portage to market. David may have been in both hunts.—Rhoads.

"The last elk killed in northwestern Pennsylvania was killed on Hick's run in the southwestern corner of Cameron Co.[?], in November, 1861. A party of old hunters, accompanied by a boy about twenty years old, went in pursuit of elk [namely], William Pepper, Ben. Sweezy, Enoch Sweezy, Hamilton Sweezy (the boy) and Frank Lewis. They found the trail of an elk on Hick's Run, and Hamilton Sweezy having strayed away from the rest, was about to to shout to his comrades when he heard the baying of hounds. He stood still and soon saw an elk coming toward him. It passed within four rods, and as it did so he shot it, the elk running about 10 rods and falling dead, leaving Hamilton Sweezy the honor [?] of killing the last elk in northwestern Pennsylvania, or perhaps the last one in this state."—Dickinson. "Once very plentiful all through the Allegheny range of mountains. Last killed in winter of 1861–62, on Hick's Run, Cameron Co., by Pepper and Sweezy."—W. Dickeson. [Not Dickinson, *supra*.]

I was told by the hunters in our engineering camp, about 40 years ago that one had been killed [?] a year or two before that [1857?] near where we were camped on one of the branches of Elk Creek, in Elk county, in this state."—Prof. J. E. Rothrock, Oct. 1899.

Forest Co.—"There were elk here until, say 1835."—Hazlet. "Early settlers saw and killed them up to 1830, I understand from good authority."—Irwin.

Erie Co.—Place-names, Elk Creek, E. C. Twp., and E. C. P. Office in southwestern part of county. See under Erie Co. in the notes on American Bison, by Ashe, next article.

Jefferson Co.—Place-names, Elk River in the north, and Little E. River in the south of Co.

Luzerne Co.—In "Bartram's Observations" (London, 1751, p. 27), it is recorded that fresh tracks of elk were seen above "Cayuga Branch, near Tohiccon," on the Susquehanna River, and later (p. 68), he states under date of Aug. 10, 1742, "Just above the junction of the east and west branches of the Susquehanna River, where was a lick, one of the Indians shot and wounded an elk." On that day they made an observation and found the latitude to be 41½°.

Lycoming and Tioga Cos.—The wapiti is "now almost extinct in most parts of Pennsylvania. * * * I found their horns repeatedly in the woods, mossy and gnawed by mice or wolves. A pair of elks were shot on Pine Creek in the spring [1835], and a herd of 13 was killed by a couple of hunters in February of last year [1834], near the headwaters of Pine Creek."—R. C. Taylor in Loudon's Magaz. N. Hist., vol. 8, 1835, pp. 536, 539.

McKean Co.—"In 1835 my father, Edward Dickinson, who was a green hunter at that time, killed two large buck elk on Colegrove Brook in Norwich Township, McKean county."—C. W. Dickinson. The specimen of male elk in the museum of the Academy of Natural Sciences, Philadelphia, was not killed in Potter county, as often stated, but in McKean county.—W. W. Larrabee's statement to S. N. Rhoads in 1896. "In the forepart of the 19th century elk were very plenty in this part [south part] of the state."—C. W. Dickinson.

Mercer Co.—B. S. Stokley, in Memoirs of the Histor. Soc. Penna. (Vol. 4, 1846, p. 77), writes: "One Buffalo horn and two Elk horns were found in 1795 and 1797 [in Mercer Co.]." "A few Elk were seen and one killed near the western boundry of the county since 1794."

Monroe and Pike Cos.—"The Elk was probably never as numerous in this [Pocono] region as in the central Allegheny mountains, those individuals taken in former days being considered by the [present] natives as stragglers from the main body. The last capture in Pike county was probably not later than 1840 or 1845." See Rhoads, Proc. Acad. Nat. Sci., 1894, p. 389.

Northampton Co.—This Co. was included in the area alluded to by Penn in his letter to the Free Traders in 1683 as containing "the elk as big as a small ox." Then part of Bucks Co.—Rhoads.

Philadelphia Co.—Peter Kalm in his "Travels" (Vol. 1, p. 336), says that an Indian living in 1748 had killed many "Stags" on the spot where Philadelphia now stands. See also (antea) for references to eastern Penna. There is much reason for believing this seemingly extraordinary statement.

The Virginia deer was not intended by it, that animal still being found in Phila. Co. during Kalm's stay. It should be remembered that the occurrence probably happened in the latter part of the 17th century, before Penn's arrival in America.

Potter Co.—"About 1870 one was brought through our town [Canton, Bradford Co.] which was killed in Potter Co., Pa. The first settlers found them all through Northern Pa."—Dr. J. E. Cleveland (first letter of Oct. 30, 1899). "I was living in Union [township] at the time I saw the elk in question. They [the 2 hunters] passed through Canton as there was no other way leading to Bradford Co. I call to mind the barn where they fed their team and other circumstances, that fix the date as being in the fall of 1862 or '63. I saw the hunters when they were on their way to Potter Co., a father and son. They had two deer hounds with them. The old man told me that he had formerly killed a number of elk, and that he had been informed that signs of elk had been seen, where he had formerly hunted, in Potter Co. In about two weeks they returned with a dead bull elk in their sleigh. If I learned their names at the time, I have forgotten them." "J. M. Whitcomb of Union [township] says that he visited a hunter's lodge in [the Black Forest] Potter county owned by two brothers named Wilcox from Bradford county. They had a dead elk in camp. This was in the early sixties."—Dr. J. E. Cleveland (second letter of Feb. 8, 1901). "I am glad to be able to produce a witness to corroborate my previous statements regarding the elk I saw brought through Union, Pa. Alonzo Thomas, aged 77 years, whose Post office address is Alba, Bradford Co., Pa., informs me that Sheffield Wilcox, late of Albany, Brad. Co., Pa., told him that the last bull elk heard of on his hunting ground he [Wilcox] killed in Potter county, Pa., in 1862 or '63. Mr. Thomas says that the direct route from the 'Black Forest' of Potter Co. to Mr. Wilcox's home in Albany would be through Liberty, Union and Canton. Mr. Thomas has probably killed more game than any other man now living in this vicinity. He hunted for elk in Potter Co. with Mr. Wilcox sixty years ago. Mr. Thomas lives about five miles from Canton, is a well-to-do farmer and highly respected. In looking over the history of Bradford Co. I find that Sheffield Wilcox, Sr., with a large family, located in Albany Twp. in 1801. Sheffield Wilcox, Jr., was the hunter."—Dr. J. E. Cleveland (3d letter of Feb. 19, 1901).

"The last Elk taken in this county was killed on the head waters of the West Branch of Pine Creek, somewhere about 1845 or '46. In 1852 I was in a camp for some time, occupied by Mr. John Jordan, on a branch of the First Fork of the Sinnemahoning. Mr. Jordan described graphically the hunt. There were several engaged in it, but the exact date, if told, I do not remember. They had practically disappeared at that time, and the discovery of this one raised a furor amongst the hunters, of whom Mr. Jordan was one.

This was in Potter Co. In the spring of 1857, we saw tracks of many wild beasts in wet places in the bottoms near Austin, where I had settled the preceding year. One morning my 2 boys saw some tracks and said that somebody's cow had got lost in the woods. Now no stray cow could have been in that place at that season. I saw the tracks; they were strange to me, but Mr. John Glassby, and Cliff Haskins, old hunters, pronounced them Elk tracks, and said they were probably some strays passing from Pine Creek [Potter Co.] to Elk and Forest counties, and would take the route through the deer licks up the creek (Freeman's Run) to the Salt Spring in Portage Twp., this county. This they did as known by their tracks; I myself seeing them for three miles on their route, and hearing of them to beyond the big Salt Lick. No others were ever seen to my knowledge after these."—E. O. Austin.

Somerset Co.—"Exterminated. Last seen in this section [Elk Lick] about 45 years ago."—Mier, 1902.

Sullivan Co.—"The last one killed was in the early part of the 19th century, in the western part of the county."—Behr.

"NEW ALBANY, BRADFORD CO., PA.,
March 26, 1901.

"The information I can give you in regard to the elk in what is now Sullivan Co. is very meagre indeed. I am sorry I cannot give you something more definite, but to fix dates definitely after lapse of many years where there are no records, is almost impossible. Elkland township, now a moderately sized township in Sullivan Co., adjoining Bradford Co. on the north, was erected as a part of Lycoming in 1804, and contained at that time a large territory, larger than all of Sullivan Co. now. It was so named on account of its territory being a great range for elk long before the township was erected: it was known as "The Elklands." A small lake in this township bears the name Elk Lake. Joel McCarty, one of the early settlers, saw at one time seventeen elk in this lake. He shot some, I cannot say how many. This was about ninety or ninety-five years ago. Wm. J. Eldred, Esq., who died in 1888, aged 82 years, and was born here, often told me of seeing a drove of fourteen elk as he was traveling along the "Old Gennessee" road which leads over the mountain from here to what is now Towanda. As near as I can tell, this was eighty years ago. Chas. Mullen killed at least one elk in this township.

The last elk killed in this region (Sullivan, Bradford and Lycoming Cos.), was killed near Ringdale, Sullivan Co. [on the south branch of Loyalsock Creek]. about 1830, by Messrs. Wilcox and Northrop (presumably Sheff. Wilcox). They started him near New Albany, Bradford Co., and chased him, the snow being deep, they wearing snow shoes.

"I know of no specimens left here. When a boy one of my uncles had

a pair of antlers. These were the only pair I ever saw that came off elk that ranged the hills of Sullivan.

"Yours very truly, ULYSSES BIRD."

Susquehanna Co.—Place-names, two Elk Lakes in southwestern part of Co. and Elk Mt. in southeastern part. "Now and then an elk was seen in Ararat Twp." (p. 480). Near Harmony (northeastern Twp.) in 1820 John Wrighter "has seen from 30 to 40 elk at one time near his home, with horns so large they appeared like immense chairs on their heads" (p. 484). Clifford township "was long known as the 'Elkwood's Settlement,' the township as well as the mountain being the home of the elk in great numbers."—E. Blackman, Hist. Susq. Co., 1873.

Tioga Co.—"Samuel Wedge of Miles Valley was one of a party which in 1858 or '59 caught 3 elks alive in Tioga Co., and brought them to Wellsboro."—Mrs. J. H. Harmon of Wellsboro. See also (antea) under Lycoming Co.

Venango Co.—"I can find no record that the elk or wapiti have been seen or killed [in Venango Co?] in the last 30 years."—H. C. Dorworth, 1901.

Wayne Co.—It is stated in Goodrich's History of Wayne Co. (Bethany, 1880) that the wapiti was never very numerous in that county. Their favorite haunt lay in a tract of 11,526 acres in the township of Canaan, called Elk Forest. Asa Stanton of Waymart is said to have (in 1880) the horns of one killed in Canaan township. The last one heard of was in 1830. The last one killed in Wayne Co. was taken "about 60 years ago" [1839 or '40].—Elijah Teeple (letter of Nov., 1899).

York Co.—Several foot bones and the head of a femur of the wapiti were taken from surface excavations made by Atreus Wanner on an Indian village site at York several years ago. I examined these specimens in the Museum of Science and Art, University of Penna., Phila. They were identified by Prof. E. D. Cope, and undoubtedly had been the accompaniment of an Indian feast in comparatively recent times.—S. N. Rhoads, 1902.

For other records see list of "fossil species."

Records in N. J.—Bergen and Hudson Cos.—In Vanderdonck's New Netherlands, buffaloes and elk are enumerated as being found on the western shores (or territory) of New York Bay, when discovered by Hudson.—Rhoads.

(*Burlington Co.?*)—"There are great numbers of wild deer [-Virginia deer] and red deer [-wapiti] also, and these wild creatures are free and common [property] for any to take and kill." See Gabriel Thomas' Hist. of West N. J., 1698, p. 23. See also (antea) Kalm's evidence, under eastern Penna. records.

(*Cape May Co?.*),—In Plantagenet's New Albion (1648) is quoted a letter of "Master Evelyn," who says in connection with a description of the shores of Delaware Bay in Cape May Co.: "There is much variety of . . . fish,

whales and grampus, elks, deere that bring three young at a time." See Geology of Cape May Co.—Cook, 1857.

Mercer Co.—"Various bones of elk from aboriginal refuse heaps near Trenton are in the Peabody Museum of Archæology at Cambridge, Massachusetts."—Dr. C. C. Abbott.

Sussex and Warren Cos.—"A hunter near Delaware Gap, N. J., declared that his grandfather, who 'killed the last elk shot in Pike county,' Pennsylvania, stated that sometimes the hounds would drive both elk and deer across the Delaware River onto Kittanning Mountain."—See Rhoads, Proc. Acad. Nat. Sci., 1897, p. 25.

Family BOVIDÆ; Oxen, Sheep and Goats.

Genus *Bison* Hamilton Smith.

American Bison or Buffalo. *Bison bison* (Linnæus).

1758. [*Bos*] *bison* Linnæus, Systema Naturæ, vol. 1, p. 72.

1888. *B*[*ison*] *bison* Jordan, Manual Vertebrate Animals, p. 337.

Type locality.—Mountains of S. E. United States.

Faunal distribution.—Lowlands from the Rocky Mountains to the Atlantic Ocean and from the Great Lakes and Saskatchewan to the Gulf of Mexico near lat. 25° occasionally wandering from these into the foothills and passes of the Rocky and Alleghenian mountains.

Distribution in Pa. and N. J.—No record of the existence of the bison in New Jersey in recent times, save the one given by Vanderdonck (l. c.), has been found. Its sub-fossil remains have been found near Trenton, as also in the Delaware valley near the Water Gap in Penna., indicating the ancient proximity of its eastern wanderings to New Jersey soil and the possibility of its fortuitous presence in that state during the age of the Red Man.

In Pennsylvania once normally found in the valleys and mountain glades of the Ohio, Monongahela and Allegheny Rivers, whence it passed sparingly eastward across the Allegheny passes into the tributary valleys of the Susquehanna, thence reaching the Delaware Valley as a straggler only. For a fuller discussion of this, see Rhoads, Proc. Acad. N. Sci., Phila., 1895, pp. 244–248; also 1897, p. 207.

Records in Pa.—Armstrong Co.—Two townships in the southwestern corner and a creek flowing through them into the Allegheny River are named Buffalo.

Bedford Co.—A creek, a mountain and a mill-village near each other in the west-central part of Co. have this name.

Butler Co.—The southeastern corner of this Co. is named Buffalo town-

ship. It adjoins the township of the same name in Armstrong Co., and a bend of Buffalo Creek intersects it.

Centre Co.—Buffalo Run flows north along the Bald Eagle range in the central part of this county.—Rhoads.

Clearfield Co.—The region of Clearfield Creek was so named (and from it the county) because "the buffaloes formerly cleared large tracts of undergrowth so as to give the appearance of cleared fields."—See Rev. John Ettwein's "Notes of Travel from the north branch of the Susquehanna to Beaver, Pa." in 1772, in the Pa. Mag. Hist. for 1901, published by the Historical Society of Pa.—Jordan.

Crawford and Erie Cos.—In a History of this Co. (1885, p. 260), a quotation is given from a French memoir written in 1714 stating, "Buffalos are found on the south shores of Lake Erie, but not on the north shore."—Kirkpatrick. "Buffalos ranged south from Buffalo, N. York through Erie, Crawford, Venango and Mercer Cos. French Creek, draining this region in Pa., was called by the French before the revolution 'La Bouffe River' because of the buffaloes found there."—Irwin. A township in southern Erie Co. where French Creek (Le Boeuf Creek) in part has its rise is still named Le Boeuf; also a village in the same township and the most northern affluent of the same creek in Green Twp.—Rhoads.

"The Onondargo [Lake, N. York] which has a portage communication with [the sources of the Allegheny] River, is a fine lake of brackish water, surrounded by springs, from two to five hundred gallons of the water of which make a bushel of salt. * * All the [domestic] animals of those parts have a great fondness for salt. The native animals of the country, too, as the buffalo, elk, deer, etc., are well known to pay periodical visits to the saline springs and lakes, bathing and washing in them, and bathing in the water till they are hardly able to remove from their vicinity. The best roads to the Onondargo from all parts are the buffalo tracks, so called from having been observed to be made by the buffaloes in their annual visitations to the lake from their pasture grounds; and though this is a distance of above two hundred miles, the best surveyors could not have chosen a more direct course or firmer or better ground. I have often traveled these tracks with safety and admiration. * * An old man, one of the first settlers in this country [Northeastern Pa., presumably Erie Co.], built his log-house on the immediate borders of a salt spring. He informed me that for the first several seasons the buffaloes paid him their visits with the utmost regularity; they traveled in single files always following each other at equal distances, forming droves on their arrival, of about three hundred each. The first and second years, so unacquainted were these poor brutes with this man's house or with his nature, that in a few hours they *rubbed* the house completely down, taking delight in turning the logs of wood off with their horns, while he had some difficulty to

escape from being trampled under their feet or crushed to death in his own ruins. At that period he supposed there could not have been less than ten thousand in the neighborhood of the spring. They sought for no manner of food but only bathed and drank three or four times a day and rolled in the earth, or reposed, with their flanks distended, in the adjacent shades, and on the fifth and sixth days separated into distinct droves, bathed, drank, and departed in single files, according to the exact order of their arrival. They all rolled successively in the same hole and each thus carried away a coat of mud to preserve the moisture on their skin, and which when hardened and baked by the sun, would resist the stings of millions of insects that otherwise would persecute these peaceful travelers to madness or even death.

"In the first and second years this old man with some companions killed from six to seven hundred of these noble creatures, merely for the sake of the skins, which to them were worth only two shillings each, and after this 'work of death' they were obliged to leave the place till the following season, or till the wolves, bears, panthers, eagles, rooks, ravens, etc., had devoured the carcasses, and abandoned the place for other prey. In the two following years, the same persons killed great numbers out of the first droves that arrived, skinned them, and left the bodies exposed to the sun and air; but they soon had reason to repent of this; for the remaining droves, as they came up in succession, stopped, gazed on the mangled and putrid bodies, sorrowfully moaned or furiously lowed aloud, and returned instantly to the wilderness in an unusual run, without tasting their favorite spring or licking the impregnated earth, which was also once their most agreeable occupation; nor did they, or any of their race, ever revisit the neighborhood."—Ashe, Travels in America in 1806. N. York, 1811, pp. 47, 48.

Cumberland Co.—Prof. Baird records finding bones of bison in caves near Carlisle in the Patent Office Reports of 1851, but on inquiry from Dr. J. A. Allen stated he could not be sure that these were of *B. bison* without re-examination.—See Rhoads, Proc. A. N. Sci., Phila., 1895, p. 244.

Elk Co.—"Running from the southeast corner of Warren Co. through McKean Co.'s southwest corner and as far as Daguscahonda [central Elk Co.], was the old Buffalo Swamp."—See Hist. Elk Co., Chicago, 1890, p. 573. This tract was at the headwaters of the Clarion and Allegheny Rivers, forming an elevated and extensive meeting place for the herds passing from one water shed to another in their circuit of the northwestern corner of the state. It would also form a northern rendezvous from which occasional herds or individuals may have strayed into the valley of the Susquehanna. Owing, however, to the absence of any record of them in Cameron, Clinton, and Potter Cos., this, if ever, was a rare occurrence, the buffaloes of Centre, Union and Perry Cos. coming east by way of Clearfield Co., or northeast by way of the Juniata via the Bedford and Somerset Co. passes from the Youghiogheny and Conemaugh.—Rhoads.

Luzerne Co.—The first and third lower molars of a bison mounted together on a card are in the collection of the Acad. Nat. Sci., Phila. These are labeled by Dr. J. Leidy as coming "With the fossil teeth [of horse, musk ox, etc.] from [Pittston] Luzerne Co., but apparently more recent *Bison americanus*." I have compared these with teeth of recent bison and find them specifically identical.—See Rhoads, Proc. Acad. N. Sci., Phila., 1895, pp. 245, 246.

McKean Co.—See above, under Elk Co.

Mercer Co.—A bison horn was found in this Co. in 1795, according to B. S. Stokley in Memoirs Histor. Soc. Penna., vol. 4, p. 77. This indicates that the bison had been exterminated in its former haunts in northwestern Pa. long before the last one was killed in Union Co. in the central part of the state. Undoubtedly the last isolated remnants of this species lingered many years in the fastnesses of the Allegheny wilderness, cut off completely from the haunts of their western ancestors by the early colonizing of the Ohio Valley.—Rhoads. See also under Crawford and Erie Cos.

Monroe Co.—A fragment of the mandible of a bison about four inches long, containing the alveoli of two missing molars and the last lower molar intact, was found in Hartman's Cave near Stroudsburg, about 3 miles from the famous Gap of the Delaware River. Leidy figured this in the Report of the Pa. Geolog. Survey for 1887, identifying it as belonging to the "bison, *B. americanus*" [= *B. bison*]. "The crown of the tooth has apparently been charred and crumbled by fire in the same manner as other bones from this cave which surrounded and lay within the site of an ancient fire place in the superficial layers of the cave floor." The ramus itself "is unburnt and is apparently of the same recent (unfossilized) age as the remains of the fox, wolf and deer associated therewith. I have no hesitation in considering Leidy's identification correct, and from the character of the ethnological remains found in the same cave and the appearance of the bone itself, would judge it had formed part of the feast of a Delaware Indian [or some wild beast] in comparatively recent times."—See Rhoads, Proc. Acad. N. Sci., Phila., 1895, p. 246.

Perry Co.—The following place names indicate the most authentic southern range of the buffalo on the Susquehanna (see antea under Cumberland Co.). They are all located in the eastern part of the Co., near the junction of the Juniata River with the Susquehanna. Owing to their number and the topographical features of their location it is obvious that buffaloes were a characteristic feature of this spot, probably crossing the Susquehanna here by way of Haldeman's Island into the mountains of Dauphin Co., on their easterly migrations from the Ohio watershed. The names are Buffalo Township, B. Bridge, B. Creek and New Buffalo.—Rhoads.

Somerset Co.—A B. Bridge on B. Creek is located in the south central part,

in Brother's Valley Twp. B. Creek is a tributary of Castleman's River near where it reaches the great divide of the Allegheny Mts. opposite the sources of the Juniata. There is a noted Elk Lick here near the Maryland boundary to which the buffaloes undoubtedly resorted, passing thence over the divide eastward toward Buffalo Mountain in Bedford Co. They may have also used the more northerly pass by which the B. & O. railroad reaches Castleman's River, going west.—Rhoads. "I am sure of one thing, the buffalo disappeared from the Co. before the Indian was driven westward. I suppose it is approximately true that the buffalo must have left the Co. some time preceding Braddock's defeat in 1755."—R. Smith in a letter to Dr. H. D. Moore.

Union Co.—"Dr. J. A. Allen, whose excellent Memoir on the American Bisons,* furnishes the best data on this subject, has conclusively proved its existence up to the beginning of the 19th Century, as far east as Buffalo Valley, near Lewisburg, in Union Co. The last buffalo killed in that region was shot by Col. John Kelly, 'about 1790 or 1800,' on the McClister farm adjoining his own, and situate in Kelly Twp., about 5 miles from Lewisburg. Col. Kelly stated that an old Indian named Logan informed him of the former abundance of buffaloes in this valley."—See Rhoads, Proc. Acad. Nat. Sci., Phila., 1895, p. 244. Buffalo Valley occupies an extensive area of east central Union Co., surrounding Lewisburg and fronting on the Susquehanna for many miles, reaching back to B. Mountain by way of B. Creek and Little B. Creek, through three townships, East B., West B., and Buffalo. A place named B. Cross-roads is located in the same region. In Scull's noted map of Pa. published in 1750, a "Buffalow Creek" is practically the only geographical name given in what is now Union Co. This is significant as showing the ancient origin of the present name, indicating it as the principal route by which the buffaloes crossed from the three main branches of the Susquehanna valley to and from the mountain wilderness of Union and Centre Cos.—Rhoads.

Venango Co.—See antea, under Erie Co.

Washington Co.—In the west-central part of this Co. is a B. township, in which lies the source of a B. Creek flowing into the Ohio River.—Rhoads.

Records in N. J.—Bergen and Hudson Cos.—In Vanderdonck's "New Netherlands," both the buffalo and elk are stated to have been inhabitants of the parts of New Jersey opposite New York when Hudson discovered that region.—Rhoads.

Mercer Co.—A scapula and pelvis of recent bison (so identified by Prof. E. D. Cope) were discovered in Indian refuse heaps near Trenton by Dr. C. C. Abbott. They are now in the Peabody Archeological Museum, Cambridge, Mass.—Abbott, 1900.

* Mem. Mus. Compar. Zoöl., Cambridge, Mass., 1876.

Order GLIRES; Rodents or Gnawers.

Family SCIURIDÆ: Squirrels.

Genus *Scuirus* Linnæus, Systemæ Naturæ, 1758, vol. 1, p. 63.

Carolina Gray Squirrel. *Sciurus carolinensis* Gmelin.

1788. [*Sciurus*] *carolinensis* Gmelin, Systema Naturæ, vol. 1, p. 148.

Type locality.—"Carolina."

Faunal distribution.—Upper and lower Austral zones, from New York Bay and the Ohio Valley to the northern part of the Gulf States.

Distribution in Pa. and N. J.—The more typical southern form of *carolinensis* is only found in southermost N. J., where it is quite rare and very local in its occurrence. In other parts of the upper Austral regions of the two states it is evenly distributed, but nowhere abundant as in former days. In the mountain foothills it merges into the Canadian sub-species *leucotis*. Specimens from the mountains of northern N. J. belong more properly to that form.

Description aud habits of species.—This animal is so well known as to need no further comment, except to call attention to its differences of color and size from the northern race. These are given under the next species. The "black phase" of pelage, so common to *leucotis* is of only accidental occurrence in *carolinensis*. I have heard of the following records of this phase:

Lancaster Co., Pa.—See Rathvon's History of the Co., 1869, p. 501.

Chester Co., Pa.—One was seen by my schoolmate, Henry Zook, previous to the year 1876.—Rhoads.

Mercer Co., N. J.—Dr. C. C. Abbott has known of them being taken many years ago near Trenton. I never saw nor heard of the black squirrel in my travels in northern N. J.—Rhoads, 1902.

Northern Gray or Black Squirrel. *Sciurus carolinensis leucotis* (Gapper).

1830. *Sciurus leucotis* Gapper, Zoölogical Journal, vol. 5, p. 206.

1877. *Sciurus carolinensis var. leucotis* Allen, Monograph N. American Rodentia, p. 701.

Type locality.—Region between York and Lake Simcoe, Ontario, Canada.

Distribution in Pa. and N. J.—Transition and Canadian life zones; abundant in nut-bearing forests, but avoiding areas monopolized by coniferous trees. Owing to the almost universal destruction of conifers and their replacement by deciduous growth this species is now found in extensive Canadian areas once dominated exclusively by the Red or Pine Squirrel.

Records in Pa.—The following records have been secured chiefly with the view of determining the numerical proportions of the normal "*gray*" and the melanistic (abnormal?) "*black*" phases of color in this species, and how the ratio of "blacks" increase as we approach the Canadian life zone.

Cameron Co.—Grays and black equally divided in 1896.—Larrabee. Black as numerous as gray in 1899.—Hays.

Cambria Co.—Blacks never as plenty as grays.—Shields.

Centre Co.—Blacks occasional in this Co. in 1899.—Rothrock. Black are rare but gray abundant in 1900.—Fernald.

Clearfield Co.—Blacks as numerous a gray in 1899.—Hays.

Clinton Co.—Blacks as numerous as gray in 1899.—Hays. Black phase rare south of Elk and Clinton Cos.—Todd. Blacks less numerous than the gray in 1901.—Pfoutz. Sometimes black outnumber grays 3 to 1, and sometimes grays seem more numerous.—Nelson. During two trips into the region north of Round Island, covering about 5 weeks' hunting, I saw about half a dozen squirrels of this species, one of which was intense black, another smoky gray; the rest normal gray. They are rare on the mountain tops and were not abundant anywhere in the spring of 1896 and fall of 1898.—Rhoads.

Columbia Co.—Rare of late years (1899); about 1 black to 100 gray.—Buckalew.

Crawford Co.—Blacks numerous near Titusville in 1900.—Price. A few seen every year but less common now than gray (in 1900). In the History of Crawford Co. it is stated that the black squirrels were so common as to be a pest, the gray squirrel not appearing till the country was settled.—Kirkpatrick.

Elk Co.—Black phase rare south of Elk Co.—Todd. Black and gray plenty in Elk Co. in 1899.—Luhr. Black numerous, gray rarely seen in 1899.—Clay. Black as numerous as gray in 1899.—Hays.

Erie Co.—Black and gray evenly divided. Both scarce in 1899.—Bacon.

Forest Co.—Black often seen; more plenty than gray in 1900.—Zendle. Blacks are abundant in 1900.—Haslet. Abundant in certain years; not as plently as gray in 1900.—Irwin.

Franklin Co.—A specimen of black squirrel is in my collection shot by Amos Light near Williamson, Oct. 15, 1897. It was sent by my kind friend W. B. Crawford, who, with Dr. M. W. Strealy of Chambersburg, had been endeavoring to secure one for years in the South Mountain region, where they are very rare, though the grays are unusually abundant.—Rhoads.

Huntingdon Co.—Not many black at Mt. Union in 1896, but several are killed in the Co. every year.—Ingersoll.

Lackawanna Co.—Blacks rather rare. Have a specimen stuffed, from La Plume. Five specimens have been brought to me in as many years, 1895 to 1900.—Friant.

Luzerne Co.—Some blacks are taken each season in this Co. Three were brought into Pittston, Oct. 20, 1899.—Campbell. Only know of one taken in Luzerne Co.—It was sent to me.—Stocker.

Lycoming Co.—Not as many black as gray, but numerous.—Parker.

McKean Co.—Black phase plentiful. Ten times as many blacks as grays. W. C. Dickinson, 1901.

Monroe Co.—Saw a black fellow 2 years ago (1897). Rare in this Co.—Bisbing.

Pike Co.—Blacks occasional.—Rothrock.

Potter Co.—Plenty of blacks. Grays seldom seen here.—Austin.

Somerset Co.—Blacks rare; one shot in Shade township, Oct., 1899.—McHenry. Blacks rare in this Co.—Moore, 1900.

Sullivan Co.—Blacks often seen, but not as plenty as gray.—Bennett, 1901. About 1 in every 12 is black.—Behr, 1900.

Susquehanna Co.—I had 2 blacks taken there in Nov., 1898.—Campbell.

Tioga Co.—Still plenty, but fewer than the gray in 1899.—Babcock. Numerous, but less so than gray in 1899.—Cleveland.

Union Co.—No blacks killed (to his knowledge) in the Co. for 12 years. Chambers, 1900.

Venango Co.—Blacks plentiful in northeastern part of Co. "I hunted squirrels [there] with father 40 years and blacks always exceeded grays in number."—Dorworth, 1900.

Washington Co.—See a black occasionally.—Linton, 1900.

Wayne Co.—Rather rarely see a black. Never as common as gray here.—Goodnough, 1900. Have had several blacks to mount from Wayne Co.—Stocker, 1900. Very few here.—Kellew, 1900. Some left here.—Teeple, 1900. Very rare; have seen none for years,—Day, 1900. Occasional and decreasing. Ratio in 1900, 1 black to 75 grays; 30 years ago ratios nearly equal.—Stevens.

Wyoming Co.—"I killed two last fall (1899) against 30 or 40 grays."—Robinson.

Records in N. J.—Passaic Co.—"Very rarely met with [in N. J.]. Have seen but two specimens, both taken in Passaic Co. in December, 1860."—Abbott, in Geol. of N. J., 1868, p. 756.

Remarks.—While a study of the foregoing data gives little light on the cause of melanism in these squirrels, it is worthy of remark that there seems to be a diminution of the relative number of blacks as the country becomes deforested and settled upon. This may be the result (1) of a change in climatological conditions unfavorable to melanism or (2) of the inability of a black squirrel to escape the increasing number of hunters so easily as a gray squirrel, owing to its conspicuous color. In regard to the first suggestion it

may be added that the midday summer temperature of these deforested subcanadian areas where the blacks were once so numerous is greatly increased above that of primeaval conditions and may have been the cause of mortality among them, the greater exposure to the sum being much more detrimental to a black animal than a gray one. In regard to the second theory it may be also said that the natural enemies of the black squirrel would derive the same peculiar advantage in its capture through deforestation and consequent exposure as would man himself. In a word, the original status of the black gray squirrel is dependent on an environment combining the climate and flora of the Upper Transition and Lower Canadian life zones, in which coniferous and nut-bearing trees were normally in the proportion of about ten to one. As these conditions through human agency revert to those of the Lower Transition and Upper Austral zones, with a corresponding increase in population, the ratio of blacks to grays decreases.

Historic references.—"Squirrels came down [into the lowlands] from the higher countries into [eastern] Pennsylvania at certain seasons. The inhabitants attribute this to the coming of a rigorous winter."—Kalm's Travels, p. 316. Kalm does not share this opinion, as the year he was in Pa. (autumn of 1749) when such a migration took place, it was a mild winter. He thinks it caused by the scarcity of nuts in one place and their abundance in another. On page 320 he says that from January, 1749, to January, 1750, Pennsylvania paid bounties to lessen the squirrel pest at the rate of 3 pence a head; 8,000 being so paid! The bounty was then reduced one-half. See also, Watson's Annals, in which both gray and black squirrels are mentioned. In Ord's Zoölogy (Guthrie's Geography, 2nd Amer. Ed., 1815, p. 292) he names the black phase of Gray Squirrel as "Small Black Squirrel, *Sciurus pennsylvanica*," and in a foot note he says, "This has always been confounded with the foregoing [gray squirrel], but it is a different species. It abounds in those parts of Pennsylvania which lie to the westward of the Allegheny ridge."* This is of interest as showing that in the early part of the nineteenth century the black squirrel was, as now, more typical of *northwestern* Pa. than of any other part of the state. On the same page Ord describes and names the "New Jersey Squirrel *Sciurus hiemalis*," from Tuckerton, as being distinguished by its "bearded ears." This name is a synonym of *carolinensis*.

Description of Species.—From the common tawny colored gray squirrel of the south Atlantic lowlands, the northern form *leucotis* is distinguished by greater size and a purer gray or silvery color at all seasons, not intermixed or tipped above with reddish or tawny as in *carolinensis*. Largest individuals often approach the fox squirrel in size, being 2 to 3 inches longer than full

*Ord's name being earlier than *leucotis* would have held good for the northern gray squirrel had he given a description of it. Lacking this, it has no place in nomenclature.

grown *carolinensis* from southern New Jersey. (See under "Historic references," antea, for Ord's names and descriptions of both forms.) The black phase may be jet-black, reddish-black and grayish-black, intergrading in a large series into typical grays. "Black and gray young are found in the same nest, and black and gray adults pair promiscously so far as observed."—Nelson.

Measurements (*carolinensis*).—Total length, 455 mm. (18 in.); tail vert., 205 (8); hind foot, 60 (2⅜); (*leucotis*) 500 (19¾); 220 (8½); 70 (2¾).

Canadian Chickaree or Pine Squirrel. *Sciurus hudsonicus gymnicus* Bangs.

1899. *Sciurus hudsonicus gymnicus* Bangs, Proceedings N. England Zoölogical Club, vol. 1, p. 28.

Type locality.—Near Moosehead Lake, Maine.

Faunal distribution.—Canadian life zone, west from Newfoundland to Michigan and Minnesota.

Distribution in Pa.—Only found in the "boreal islands" of the northern tier of counties in Pa. Not present in N. J. Miller and Bangs* limit the distribution of *gymnicus* southward to northern New York. I am induced to give it a place in the fauna of Pa., because of a tendency in several specimens from the denser coniferous forests of Sullivan, Luzerne, Clinton, Cambria and Somerset Cos. to assume the character of *gymnicus*, as contrasted with *loquax* of southern N. J.

Description of Species.—As now defined, the typical form, *hudsonicus*, is confined to Labrador. Sub-species *gymnicus* differs from it in having the color darker and richer and the border of tail reddish instead of yellowish or grayish. The underparts of *hudsonicus* and *gymnicus* are *gray* in winter pelage, while in our next sub-species, *loquax*, the lower parts are pure white in winter. The hind foot in *gymnicus* averages 3 millimeters less than in the other two forms. In the Pa. specimens of *gymnicus* there is a decided departure in the greater depth of color of upper parts, the grayish tinge of the belly in winter and the undefined character of the so-called dorsal band, from *loquax* of the lower Delaware Valley. On these accounts it would better correlate with actual conditions if the southern range of *gymnicus* was extended to the Transition border of the Canadian Life Zone. The more this question is examined the more am I convinced that the eastern Chickaree does not merit sub-division into more than two geographic races—*hudsonicus* inhabiting the Hudsonian and Canadian Zones with gray underparts in winter, and *loquax* the Transition and Upper Austral with underparts always white. The evident inability of logically or geographically defining *gymnicus* is patent in literature. As in the case of the black squirrel there has been

* See Bull. N. York S. Mus., 1899, vol. 6, No. 29.

such a change in forest conditions where *gymnicus* was once found in Pa. that it may soon become difficult to secure anything but *loquax* in those regions.

Measurements (*gymnicus*).—Total length, 290 mm. (11½ in.); tail vert., 120 (4¾); hind foot, 44 (1¾); (*loquax*) 315 (12½); 130 (5⅛); 47 (1⅞).

Southeastern Chickaree or Red Squirrel. *Sciurus hudsonicus loquax* Bangs.

Sciurus hudsonicus loquax Bangs, Proceedings Biolog. Society, Washington, vol. 10, p. 161.

Type locality.—Liberty Hill, New London Co., Connecticut.

Faunal distribution.—"Deciduous forests of the Transition and Upper Austral zones of the eastern United States" (fide Miller). See foot-note under *S. h. gymnicus.*

Distribution in Pa. and N. J.—Abounding everywhere below the Canadian zone, where forests, groves or private grounds afford necessary shelter and food. Semi-domesticated in some towns and villages and becoming a pest on account of its robbery of birds' nests. Ever persecuting, and said to destroy, the Gray Squirrel. By no means confined to deciduous forests but rather preferring pine lands, where they are most numerous in southern and eastern N. J. In this last particular I must take exception to Miller's restriction of their habitat, as above quoted.

Description of species.—See antea, under *S. h. gymnicus.*

Western Fox Squirrel. *Sciurus rufiventer* E. Geoffroy.

1803. *Sciurus rufiventer* E. Geoffroy, Catalog. Museum d' Histoire Naturelle, p. 176.

Type locality.—New Orleans, Louisiana.

Faunal distribution.—Upper Austral and Lower Transition zones from the Allegheny Mountains (western base) to the Mississippi Valley.

Distribution in Pa.—Having examined no specimens from Pa. west of the Alleghanies,* I cannot verify the probable presence of this form in extreme southwestern Pa. as implied by Miller in his Key to Mammals of N. East N. America, p. 87, where he says it occupies the Transition and Upper Austral zones of "the region immediately west of the Alleghanies." That the fox squirrel was found in this region is well established, as the succeeding records will show. It is probably extinct there now, though there is a possibility of some old mounted specimen being found in a condition which would enable us to decide whether typical *rufiventer* belongs in this list.

* See however under list of American species introduced into Pa. and N. J.

Records in Pa.—Beaver Co.—Said to have been taken several times in B. Co. in recent years.—Todd, 1901.

Washington Co.—One killed near the capital of W. Co. about 1870. Once numerous; now about extinct.—Nease, 1900. Seen occasionally in this Co.—Linton, 1899.

Description of species.—Size not much greater than the northern gray squirrel (*S. c. leucotis*), much smaller than the southern fox squirrel (*S. niger*). Ears and nose never white. Colors variable, but much deeper and more ferruginous than in the next sub-species (*S. rufiventer neglectus*); sometimes wholly black, or black-bellied with reddish gray upper parts, others again are orange beneath. In *S. r. neglectus* the size is larger than in *rufiventer*, the belly usually white. Wholly black individuals of *neglectus* are rare, according to Bangs.

Measurements (*rufiventer*).—Total lenth, 541 mm. (21½ in.); tail vertebræ, 252 (10); hind foot, 73.7 (2⅞); (*neglectus*) 590 (23¼); 270 (10½); 73 (2⅞).

Northeastern Fox Squirrel. *Sciurus rufiventer neglectus* (Gray).

1867. *Macroxus neglectus* Gray. Annals and Magazine N. History, 3rd series, vol. 20, p. 425.

1902. *Sciurus rufiventer neglectus*, Allen, Bulletin Amer. Museum Nat. History, vol. 16, p. 167.

Type locality.—Wilmington, Delaware.

Faunal distribution.—"The northeastern fox squirrel is an inhabitant of the Upper Austral zone but occasionally wanders into the Transition zone."—Miller. Now rarely found in *Pa.* except in the Lower Transition zone.

Distribution in Pa. and N. J.—Once found over all parts of the two states except in the Canadian and Upper Transition areas of the mountains. Probably always rarer in Chester and Delaware Cos. and in southern N. J. than in south central Pa. and northern N. J. Now exterminated in N. J. but found occasionally in the Pa. counties bordering the lower Susquehanna, also yet recorded from the northwestern part of Pa. Destined to extermination in our entire limits unless large areas of country in middle Pa. revert to a wilderness condition or become game reservations under state protection.

Records in Pa.—Adams Co.—Warren, Poultry Book, p. 507.

Cameron Co.—Very rare; none seen for years in Cameron Co.—Larrabee. This record has not much significance, as it is not likely that the fox squirrel was ever found, except as a rare straggler after the coniferous forests became destroyed in the counties of Pa. which lie almost wholly within the Upper Transition and Canadian life zones. See negative records under Clinton, Forest, McKean, Lycoming, Potter, Sullivan, Tioga and Venango Cos.—Rhoads.

Clinton Co.—Nelson's record of 3 killed in 1894 (Proc. Acad. N. Sci., Phila. 1879, p. 216) is wrong. The "fox squirrels" subsequently sent me by Nelson were only very large gray squirrels with an unusual amount of rusty on feet, sides, neck and mouth.—Rhoads. None ever found in these parts (Mill Hall, Clinton Co.).—Pfoutz. Listed by Warren in Poultry book, p. 507, probably on my authority as above corrected.—Rhoads.

Crawford Co.—Rare. Two specimens from Huidecoper's Hill, Vernon Twp., near Meadville, were taken respecrively in October of 1898 and 1899. "The last one is in my collection."—Kirkpatrick.

Cumberland Co.—I mounted 3 killed in Cumberland Co. in 1893.—Friant. Listed by Warren in Diseas. Poultry, 1897, p. 507. "One reported seen near Pine Grove Furnace in 1892." Nearly exterminated.—Rhoads, 1897, Proc. Acad. N. Sci., Phila., p. 216. "Dr. B. H. Warren writes me that the northern fox squirrel is practically extinct in Pennsylvania except in the counties of Dauphin and Cumberland."—Bangs, Proc. Biolog. Soc., Washn., 1896, p. 150, foot note. A specimen from Carlisle, probably from the National Museum collection and collected by Baird, is listed by Bangs as having been examined.—Ibid, p. 153.

Chester Co.—Listed by Michener in Hist. Ches. Co. as "rare," but this list is not reliable.—Rhoads.

Dauphin Co.—See above, under Cumberland Co.

Delaware Co.—Listed as "rare" by Cassin in Appx. to Hist. Del. Co., 1862.

Elk Co.—The last one was killed in 1889 in Elk Co.—Hays. I am doubtful of this record.—Rhoads.

Fayette Co.—Two specimens from Rothrock are listed by Bangs as coming under his notice in Proc. Biol. Soc. Washn., 1896, p. 153.

Forest Co.—Not found in Co.—Haslet.

Franklin Co.—Two specimens in my collection. One taken Sept. 24, 1896, by J. H. Light near Williamson, the other shot Oct. 16, 1897, by C. M. Deatrich near St. Thomas. Secured through Drs. M. W. Strealy and W. B. Crawford, of Chambersburg.—Rhoads. A black fox squirrel was shot about 1880 in northwest Franklin Co. in South Mountain. Several remain in the South Mountains. One shot by Dr. W. B. Crawford in 1896.—Strealy. Listed by Warren in "Poultry" book, p. 507.

Fulton Co.—Listed by Warren in Diseas. Poultry, 1897, p. 507.

Huntingdon Co.—Listed by Warren, l. c.

Juniata Co.—Listed by Warren, l. c.

Lancaster Co.—Cat or fox squirrel is given by Rathvon in his animal list in Hist. Lanc. Co., 1861, p. 501.

Lycoming Co.—Not seen in this Co.—Parker, 1900.

McKean Co.—Unknown here.—Dickeson, 1900.

Montgomery Co.—"Rare," as listed by Buck in Hist. Montg. Co., 1884, p. 436.

Mifflin Co.—A few killed recently (1899) in the Co.—Rothrock. Listed in Warren's "Poultry" book, p. 507.

Northumberland Co.—"We have seen it near Easton."—Audubon and Bachman, Quad. N. Amer., vol. 1.

Perry Co.—Listed in Warren's "Poultry" book, p. 507.

Sullivan Co.—"Rare (reddish), not on top of mountains, near Eaglesmere."—Bennett. From other sources I am led to question the existence of this species in Sullivan Co. Probably Bennett refers to the large rusty-colored gray squirrels which are sometimes taken on the foothills.—Rhoads.

Tioga Co.—None in Tioga Co. or this part of Pa.—Babcock. Never heard of one in Tioga Co. or northern Pa.—Cleveland.

Venango Co.—Never saw one in Venango or other northern Cos., though a hunter of squirrels 20 consecutive years. No records known to him.—Dorworth.

Wayne Co.—I shot one or two many years ago. Always rare in Wayne Co.—Goodnough, 1900. Never had any in Wayne Co.—Stevens.

Wyoming Co.—"The only place I know of its being found is in Wyoming Co."—Stocker. I never heard of one here in Wyoming Co.—Robinson.

York Co.—"We have seen it near York."—Audubon and Bachm., Quad. N. Amer., vol. 1. Listed in Warren's "Poultry" book, l. c., p. 507.

General Records.—"Shot at rare intervals in some of the northern counties" of the western border of Pa.—Todd. Specimens of the light gray phase of Pa. fox squirrel presented to the Academy of Nat. Sci., Phila., long ago by Drs. Heerman and Woodhouse have no definite locality, but probably came from localities east of the Susquehanna River. Mr. Ingersoll was unable to get any reliable notes of this species in his journey through Juniata, Huntingdon, Blair, Cambria, Somerset and Bedford Cos. in 1896. Old hunters with whom he conversed had only known of them in the distant past.—Rhoads. "This species is generally known in southeastern Pennsylvania, where it chiefly abounds, as the fox squirrel."—Baird, Mam. N. Amer., 1857, p. 250.

Records in N. J.—Mercer Co.—"Specimens of this squirrel have been quite frequently met with in the past three years. They seem to prefer a clump of large shell-bark hickories with open ground about them."—Abbott, Geolog. Surv. of N. J., 1868, p. 756. Escaped from cages and increased for a time. Now exterminated.—Abbott, 1900.

Southeast N. J.—"The southeastern portion of N. Jersey seems to be well suited to them."—Audubon and Bachman, Quad. N. Amer., 1849, Vol. 1. "Not abundant."—Beesley, Geol. Surv. C. May Co., 1857, p. 135.

Northern N. J.—"Even the former existence of the fox squirrel in northern N. J. rests on such unreliable evidence that I am unwilling to include it." —Rhoads, Proc. Acad. N. Sci., Phila., 1897, p. 30. "I can get no information of any having been taken lately in New Jersey."—Bangs, Proc. Biol. Soc., Washn., 1896, p. 150.

Description and Habits.—For the characters of this race see above under *S. rufiventer*. So far as I have read there is nothing to distinguish the habits and habitat of this species from those of the gray squirrel living in the same regions. It is more terrestrial, less agile and perhaps more partial to swampy ground than the gray squirrel and is much persecuted by the latter.

Genus *Tamias* Illiger, Prodromus Systema Mammal. et Avium, 1811, p. 83.

Southeastern Chipmunk; Striped or Ground Squirrel. *Tamias striatus* (Linnæus).

1758. *Sciurus striatus* Linnæus, Systema Naturæ, vol. 1, p. 164.

1857. *Tamias striatus* Baird, 11th Smithsonian Report (Washington, D.C., U. S. A.), p. 55.

Type locality.—Southeastern United States.

Faunal distribution.—Upper austral and lower transition zones; Atlantic Ocean to Indian Territory.

Distribution in Pa. and N. J.—Found abundant in the Austral and Transition regions of both states except in southern, and more especially southeastern, N. J., where it is rarely met with, though not absent from any county. As it nears the Transition areas it becomes exceedingly abundant and gradually assumes a lighter color which, in the "boreal islands" of the Pa. mountain tops, merits classification with *T. s. lysteri*, the form next to be considered. For further discussion of habits, economic status and specific characters the reader is referred to subspecies *lysteri*.

Northeastern Chipmunk. *Tamias striatus lysteri* (Richardson).

1829. *Sciurus* (*Tamias*) *lysteri* Richardson, Fauna Boreali-Americana, vol. 1, p. 182.

1886. *Tamias striatus lysteri*, Merriam, American Naturalist, vol. 20, p. 242.

Type locality.—Penetanguishene, Georgian Bay, Ontario, Canada.

Faunal distribution.—Upper Transition and Lower Canadian zones; Maine to Lake Superior.

Distribution in Pa. and N. J.—See under *striatus*, above. Not found in N. J.

Records in Pa.—Specimens most nearly approaching typical *lysteri* in my

collection from the mountains of Pa. are almost as near to N. J. *striatus* in their coloration as to *lysteri* from Maine. On the basis of palest specimens those in the collection coming from Eaglesmere, Sullivan Co., and from the mountain tops of Clinton, McKean and Cambria Cos. are nearest *lysteri*. Specimens from the Pocono plateau are also quite pale, as well as those from Summit Mills in southern Somerset Co.

A large series from the southern end of Greenwood Lake, Passaic Co., N. J., the most boreal locality in that state, show that *lysteri* has no place in her fauna.

Habits, etc.—Some peculiarities of this species are worthy of note. They hibernate, as is generally supposed, at the approach of frosty weather and come out again in spring; say about the first of April. At Greenwood Lake they were amazingly abundant, and during the whole time spent there, the last week in October, though the temperature descended to 20° there was no sunshiny day that did not bring them out by 9 or 10 o'clock. Of forty specimens secured there, no really fat one was found among them, though the acorns, which they were busily harvesting and storing away, were abundant. This is contrary to the usual condition of hibernating animals at that season. I have been told by Seth Nelson of Clinton Co., and Otto Behr of Sullivan Co. that sometime in February tracks in the snow show that chipmunks emerge from their homes and caper about. Nelson thinks this is their rutting season and that the females do not again come out of their burrows until the young are quite large, and much later than the males in spring. I cannot vouch for this idea, but if true it has its exceptions, as I have shot in late October young chipmunks about two-thirds grown, which could not have been born much earlier than late July. Nevertheless, I have never, at any season, secured a gravid female, but suckling ones have been sometimes taken in an advanced stage towards weaning. It is not unlikely that the female chipmunk during parturition and for some time after the birth of her young does not leave the burrow, but either lives on the food she has stored there, or is fed by her male partner. While autumn is the time of greatest excitement among chipmunks, I have been unable to certainly discover that this is the rutting season. That late autumn or early winter is the rutting season for the tree squirrels, including the flying squirrel, there seems no doubt, as their young may be found in the nest in February and March. That many chipmunks enter and appear to be at home in the same burrow in the late fall is evidenced by my having trapped at the mouth of a single burrow, between the 15th and 25th of October, on the mountain 3 miles above Round Island, Clinton Co., Pa., seven full-grown chipmunks, of which 1 was an adult female, one an adult male, one a young female and four young males. Three of the young males and the young female were so nearly alike in size that I think them the offspring of the old pair, and that it was likely they all were

expecting to hibernate, with the exception of the fourth young male, in this retreat. Of course this is only circumstantial evidence, but it is probable, as the four young were hardly able to hew out among those rocky fastnesses a retreat for themselves that year. In this same locality, though snow and hard freezing weather intervened, the chipmunks would respond to a thawing, sunshiny day as late as the 10th of November, about the time we returned to Pittsburgh. That the chipmunk varies its vegetable diet of nuts, seeds, grain, buds and fruit with entrees of animal food is noteworthy. They not only eat insects, snakes, mice, birds, eggs and various species of shelled snails, but have been known to devour each other when wounded or caught in a trap. As they are exceedingly abundant in many parts of the Transition zone, and very fond of grain, those fields of wheat, oats and maize, etc., bordering upon woodland suffer not a little from their thefts, but as their main food supply is taken from nature's spontaneous gifts their economic status is not a serious problem. On the other hand, they are by far the most numerous, entertaining, confiding and innocent of the very few diurnal mammals which continue to exist in our populated districts.

Description of species.—It will be sufficient to merely note the differences distinguishing true *striatus* from its more northern representative *lysteri*. The latter is rather longer tailed, has a longer hind foot but does not seem so heavily built; more slender bodied. In fact the differences in measurements are so slight in averaging a large series of each that I think the hind foot the only reliable test. In color *lysteri* is lighter (grayer) above, the crown being yellowish rusty instead of rusty brown and the back clear ash gray lacking the dark chestnut rump of *striatus*. The back stripes are also less clearly contrasted and the under surface of tail buffy instead of dark hazel.

Measurements (*striatus*).—Total length, 235 mm. (9¼ in.); tail vertebræ, 88 ($3\frac{7}{16}$); hind foot, 33 ($1\frac{5}{16}$): (*lysteri*) 235 (9¼); 90 (3½); 35 ($1\frac{6}{16}$).

Genus *Arcotomys* Schreber, Saugthiere, vol. 4, plates 207 to 211.

Southeastern Woodchuck or Ground Hog. *Arctomys monax* (Linnaeus).

1758. [*Mus*] *monax* Linnaeus, Systema Naturæ, vol. 1, p. 60.

1780. *Arctomys monax* Schreber, Saugthiere, vol. 4, plate 208.

Type locality.—Maryland.

Faunal distribution.—Upper Austral and Transition zones; Massachusetts to Georgia; west almost to the plains.

Distribution in Pa. and N. J.—More or less abundant in all localities from tide water to mountain top in Pa. within the limits of the Upper Austral and Transition zones, being replaced in the Canadian zone by subspecies

canadensis, next considered. In New Jersey numerous everywhere north of a line joining Lambertville and Perth Amboy; thence rapidly decreasing in numbers especially eastward in the pine barrens region, where they are almost unknown. In the vicinity of Trenton and Princeton they are rare, and in Camden Co. of fortuitous occurrence. Thence southward their presence is occasionally recorded in most isolated neighborhoods, seeming to set at naught the common rules of geographical and faunal distribution. The same peculiarity is noticeable in regions where they are generally abundant, certain parts of which, exactly similar in character of soil, topography, climate and flora, have been avoided by them apparently ever since the country was settled upon by white men.

Records in Pa. (Peculiar distribution.)—*Bucks Co.*—Never seen around Fallsington.—James Moon and Geo. M. Comfort. Never known in southern part of Bucks Co.—D. Ray.

Montgomery Co.—Supposedly common in eastern Pa., its distribution in Bucks and Montgomery Cos. is remarkable. The following is taken from the History of Montgomery Co., 1884, W. J. Buck, pp. 435, 436: "After most extensive inquiry among the descendants of our earliest families, the ground hog seems never to have been known in Horsham, Moreland, Abington, Cheltenham or Upper Dublin townships. Near Flourtown, Springfield twp., one was discovered about 1868 and regarded as a great curiosity. In Lower Salford they disappeared a quarter of a century ago. A few are still found in Upper Hanover and Upper and Lower Providence, but strange to say they are common around Red Hill and Eastburn's Hill in Upper Merion.

Records in N. J. (chiefly extralimital.)—*Atlantic Co.*—Two were reported captured near Egg Harbor and there exhibited about 1880.—Rhoads.

Burlington Co.—"Very rare near Medford. About the year 1874 one was killed on the south branch of Rancocas Creek near my farm."—Geo. Haines. Joseph S. Evans in answer to a letter to William B. Evans of Moorestown writes: "I remember in the summer of 1898 we cought one in a rail pile and I think I remember hearing of one being caught in Edw. Darnell's potato patch last summer [1901] near Mount Laurel, Father says he only remembers seeing 3 or 4 in his lifetime [near Marlton]."

Camden Co.—One was killed near Haddonfield, April, 1890, in a burrow along the road to Chew's Landing. It was mounted for, and is now in the possession of John Hutchison. This is the only record known to me for Camden Co. during a residence there of nearly forty years.—Rhoads, 1901. An adult specimen was taken alive in July, 1902, on a farm near Ashland and seen by me in Haddonfield.—Rhoads.

Cape May Co.—"A few are found at the head of Cedar Swamp Creek, Upper township."—Hand, 1901.

Cumberland Co.—Saw one near Greenwich about 50 years ago. The only one.—Williams, 1902.

Mercer Co.—"Not common around Princeton; even on the Rocky Hill range it is scarce. I have several skins from this locality, but have not seen more than a half dozen in the last ten years."—Phillips, 1901. Occasional in vicinity of Princeton.—Scott. Not uncommon in this Co., but more abundant in adjoining Cos.—Abbott, 1900. "In the last five years have collected six adult specimens from Mt. Lucas. It is supposed to be rare, as traces of it are seldom seen."—Silvester, 1901. None seen around Lawrence Sta.—McGuigan, 1901. One taken alive near Lawrence and taken to Trenton as a curiosity.—D. Ray, 1901.

Morris Co.—Several are found on farms near Gillette, in 1901.—Rhoads.

Ocean Co.—One found in burrow on McCoy farm near Tuckerton (about 1880?).—Jillson. One shot by Horace Pharo on Pharo farm at Tuckerton about 1894.—Rhoads. One killed near Tuckerton in summer of 1897 and another in 1898, so Jillson says,—Price, 1901.

Salem Co.—"About 30 years ago [1872] there was a burrow of the Ground hog along the hill sides of Mannington Creek."—Caspar W. Thompson. "Our country [Salem Co.] was the home of but one species of Marmot, familiarly known as Woodchuck. They lived in communities and burrowed in wooded hillsides."—W. Patterson in "Extinct Fauna of Salem Co.," read before the Salem Co. Histor. Soc., Mar. 10, 1896.

Union Co.—"One seen (by me) south of First Mountain, near Plainfield, Aug. 14, 1898. Another seen on Second Mountain, near Plainfield, April 23, 1899. Never seen south or east of Plainfield."—Miller.

Habits, economic status, etc.—In nearly all the country covered by this paper the habits of the ground hog are too well known. In the mountainous districts where rocks abound and afford it greater security in its underground retreats, it has become a pest to the tiller of the soil because of its great abundance. There are sometimes twenty of their families on an area of 150 acres in Warren Co., N. J., where the farms reach up the sides of the Kittatinny Mountain. Most of the northern counties of the state can mourn over similar conditions. So bad are the Warren Co. ground hogs, there is a special bounty put upon their scalps in Frelinghuysen Twp. of 10 cents each, and in consequence thousands are slaughtered. The woodchuck is preeminently a grass eater, and clover pleases him all too well. The following extract from a letter by A. C. Sisson of La Plume, will illustrate how they regard him in Lackawanna Co. in northern Pa. I take it from Dr. Warren's "Poultry" book: "The ground hog is fast becoming one of the farmer's and gardener's most destructive enemies. I would most earnestly recommend legislative aid in suppressing this intolerable nuisance. There should be a bounty of at least twenty-five cents on every one killed. I have looked in vain for one redeeming trait in this sneaking, groveling curse to the agri-

culture of our State. He is a gross feeder, devouring nearly as much clover as a full-grown sheep; he eats to give him strength to dig holes, and then he digs holes to give him an appetite for more clover. He takes supreme delight in tearing the bark from young fruit trees, and will wipe out entirely a good-sized bean patch in a day."

No bounties appear to have been paid on this animal in Pa., though I make bold to assert it annually steals incalculably more value in agricultural products than the combined value of poultry, live stock, etc., which are destroyed by beasts and birds of prey coming under the ban of law. The fur of the woodchuck has no value, and very few are used for food, so that there is almost nothing "in his hide" to compensate for such thievishness as in the fox, mink, skunk, wildcat, and opossum.

Description of species and measurements.—See under subspecies *canadensis*, next considered.

Northeastern Woodchuck or Ground Hog. *Arctomys monax canadensis* (Erxleben).

1777. [*Glis*] *canadensis* Erxleben, Systema Regni Animal, vol. 1, p. 363.

1898. *Arctomys monax canadensis* Allen, Bulletin American Museum N. History, vol. 10, p. 456.

Type locality.—Hudson Bay.

Faunal distribution.—Canadian and Hudsonian life zones; Newfoundland; west to Rocky Mts.?

Distribution in Pa. and N. J.—Not found in N. J. The woodchuck of the limited Canadian areas of the northern Alleghenies may more properly be classed with the dark race of the southern Hudson Bay region than with the Maryland animal. This form is confined to the mountain tops of the northern tier of counties. It is more essentially an inhabitant of the forested lands, as contrasted with the habitat of *monax*. It is abundant.

Habits, etc.—See above, under *monax*.

Description of species.—As no specimens of typical *canadensis* have been described according to modern methods, I will take Bangs' description of *Arctomys ignavus* from Labrador as a basis for comparison with *monax*, it being probable that *ignavus* may properly become a synonym of *canadensis*. This granted, the northeastern woodchuck is larger than *monax* and of a dark grizzly gray, little varied with yellow or reddish tints, as in the latter species. The difference in size is not great, amounting in the length of hind foot to only ¼ of an inch.

Genus *Sciuropterus* F. Cuvier, Dents du Mammiferès, 1825, p. 255.

Virginia Flying Squirrel. *Sciuropterus volans* (Linnæus).

1758. [*Mus*] *volans* Linnæus, Systema Naturæ, vol. 1, p. 63.

1890. *S*[*ciuropterus*] *volans* Jordan, Manual Vertebrate Animals, Northern U. States, p. 321.

Type locality.—Virginia.

Faunal distribution.—Austral and transition zones; Maine to Georgia, west to the plains.

Distribution in Pa. and N. J.—Found in uniform abundance in all localities, so far as known. Whether it is replaced in any of the restricted Canadian areas by the large northern species, *Sciuropterus sabrinus macrotis* Mearns, has not been determined. All the flying squirrels so far examined by me from these localities have been the small species, *S. volans*. As there is a possibility of the larger species being found, the following distinctions between them may be given:

Description of species.—The Virginia species is drab on the upper parts, slightly shaded with russet, not distinctly different in winter and summer fur. The under parts are pure white to the extreme roots of the hairs. The total length is 230 mm. (9 in.); tail vertebrae 100 (4); and hind foot 30 (1¼). In the northern species these measurements are respectively: 280 (11); 125 (5); 38 (1½); and the upper parts are glossy wood brown mixed with cinnamon in winter and in summer sooty drab, the under parts being dirty white, the hairs sooty at their roots.

Family CASTORIDÆ, Beavers.

Genus *Castor* Linnæus, Systema Naturæ, 1758, vol. 1, p. 58.

Northeastern or Canada Beaver. *Castor canadensis* Kuhl, 1820. *Castor canadensis* Kuhl, Beitrage Zur. Zool. u. Vergl. Anat., p. 64.

Type locality.—Hudson Bay.

Faunal distribution.—Hudsonian and Canadian life zones; Atlantic Ocean to Cascade Mts. and Behring Sea.

Distribution in Pa. and N. J.—The typical form was never found in N. J. In Pa. this northern animal was at one time numerous in the higher mountain lakes and headwaters of the Allegheny and Susquehanna rivers. It is included in this paper solely on our knowledge of the presence of other animal forms belonging to the Canadian fauna (Lynx, Wolverene, Bonaparte's Weasel, Cope's Shrew, etc.) in the regions named. No specimens of native beaver from Pa. or N. J. being known to exist, I have been compelled to include both the northeastern (*canadensis*) and the southeastern (*carolinensis*) in this list on purely zoögeographic grounds. I have no hesitation in believing that this course would be proven correct on a basis of comparison be-

tween specimens of the original beaver stock of southern N. J. and those of the Canadian regions of Pa. It has been many years since beavers were supposed to have been exterminated in the Pa. wilderness. Whether the records of recent captures and observations of beavers in the State of Pa. are based on survivors of the native race or are strays from captivity we are not always able to discover, but in some cases, such as those mentioned under the next subspecies, they were evidently from imported stock.

Records in Pa.—Cambria Co.—The following record of a Cambria Co. beaver, coming as it does from a person of so much intelligence and fully appreciating the need of accuracy in an identification of this kind, induces me to insert it as probably correct. From the nature of its surroundings and the absence of any evidence that a game preserve was ever located in the neighborhood, it is not impossible that this beaver is one of the last if not the last representative of the old beaver stock to be found in the Middle States, unless there be some remaining in the Adirondacks, a fact not proved in Miller's recent List of New York Mammals:

"I saw a beaver on a branch of South Fork of Little Conemaugh [Portage twp.] Sept. 16th, 1899. This branch is marked on old maps 'Beaver Dam Branch,' though I do not know where or how long ago dams existed. Prior to flood of 1889, this country was almost untouched. A lumber road now runs through bed of old South Fork dam and up main fork, but much of the timber on this 'Beaver Dam Branch' is intact. Hemlocks, 3 ft. through are in great numbers. Many years ago there was a small saw-mill at about the point marked with a red dot on sketch map [near Blair Co. line]; and where the stream re-enters the forest is a big pile of rotting slabs and butts, with slack water above. The beaver was just below this and came splashing down stream toward us, plunging into a pool not ten feet away just as he saw us, apparently; for he turned under water and ran up stream, disappearing under the pile of slabs. I was uncertain as to its identity until it turned and we had a good look at close range. The valley for four miles below this point is virgin forest and only disturbed by trout fishers. In a few years, however, it will be all cut over, as the hemlock is very valuable and the mills but five or six miles down stream." Signed W. C. McHenry, Oct., 1899.

In answer to my further inquiries regarding this record, Mr. McHenry wrote as follows:

"JOHNSTOWN, PA., DEC. 18TH, 00.

"DEAR SIR: Replying to your note of 17th, relative to the Cambria County Beaver, would say that I have been unable to make another trip to the locality for additional evidence. The only doubts I had, however, were removed last winter, when, in company with the young man [Frank Phillips] who was with me on the South Fork trip, I visited the collection of mammals at the Field Museum in Chicago and carefully inspected specimens of the Beaver as well as animals with which it would be at all possible to confound it. This confirmed us both beyond doubt that the animal we saw in good daylight and so close we

could have easily shot it with a pistol, and both in and out of water, first coming directly towards us and then retreating, giving a good view of its hinder parts and tail, was a Beaver. My first impression, as the animal came towards us and plunged into the pool, was that it was an otter; this before I had a good look at it. Even when I saw the tail I could scarcely credit my senses, as I supposed the Beaver was wholly extinct, and was glad to have my friend's positive confirmation that the tail was *flat* and *naked*. It was not until after returning and on tracing our rambles on the map that I found we were on the 'Beaver Dam Branch' of the South Fork.

"If possible, I will make a trip to the spot this winter and try to confirm the record by other evidence. It may be, however, that lumbering operations have been pushed that far up stream."

Centre Co.—"According to Mr. George K. Boak, Pine Glen, Pa., the beaver was found in Centre Co. about 30 years ago."—Warren in Poultry book, 1897, p. 494.

Clarion Co.—Last killed on Sandy Creek in northern Clarion Co., near the Venango Co. line, in 1864.—Zendle.

Clearfield Co.—"Mr. Abraham Neveling, of Coalport, Pa., says, "The last beaver was trapped in Clearfield Co. in 1837."—See Warren, Poultry book, 1897, p. 494. A very large beaver meadow lies near Dubois.—Rhoads.

Clinton Co.—An old beaver dam on Fishing Creek.—Hays. Seth I. Nelson, who hunted in the thirties in Potter [and Tioga] Cos. when those counties were largely covered with virgin forest, and the elk, wolf and pekan were still numerous, never met with living beaver. In contrast with this we have the following statement from his son, Seth Nelson (Jr.): "The last [beaver] taken in this state was killed on Pine Creek nine years ago [1884]. A part of Pine Creek is in Clinton Co.,* part in Potter Co. and part in Tioga Co., but the beaver was started in Potter Co. and followed down through Tioga Co., and killed in Clinton Co."—See Rhoads, Proc. Acad. N. Sci., Phila., 1897, p. 210.

Crawford Co.—Formerly in Pymatuning and Conneaut marshes.—See local beaver names in that region.—Kirkpatrick, 1900.

Elk Co.—None known to exist in Elk Co. during my experience of 50 years.—Luhr, 1900. "At head of Bennett's Branch [near St. Mary's] is a marsh called Flag Swamp, remarkable as probably the only one in the state in which the beaver may be found [about 1850]."—See Hist. Elk Co., 1890, p. 473.

Forest Co.—There was a colony on Salmon Creek, Central Forest Co. 70 years ago.—Haslet, 1901. The Beaver Meadows in Jenks Twp. covered 2000 acres. Beavers were numerous in 1833 when Cyrus Blood settled in Jenks, but soon exterminated.—Irwin.

Jefferson Co.—Late in "the thirties" George Pelton brought beaver pelts to Brookville.—See McKnight's Hist. Jeff. Co., 1898, p. 89. These pelts

* It forms part of the southeastern boundary of the Co.

were probably taken on Beaver river, a few miles south of Brookville.—Rhoads.

McKean Co.—"About 70 years ago there was a nice beaver dam and meadow with a fine lot of beaver on the Kinzua Creek in the southwestern part of this county. This Beaver Meadow, as it was and is yet called, is about two miles above the Kinzua Viaduct. At or near this meadow is where the last beaver was caught in this county. Jerod Robison caught two or three there in 1839. I have heard it stated that beaver have been caught near these old meadows as late as the sixties, but could never hear what the man's name was who captured them."—Dickinson, 1901.

Monroe and Pike Cos.—"The older residents concur in the opinion that the beaver was exterminated nearly fifty years ago in northwestern Pa. Their dams and meadows are still pointed out in numerous places along Bushkill and Dingman creeks."—See Rhoads, Proc. Acad. Nat. Sci., Phila., 1894, p. 390.

The following notice of living beavers in Monroe Co. was published in the Sunday *North American*, Dec. 15, 1901:

"The animal population of Pennsylvania has lately been augmented by the arrival of a score of beavers. Where they came from, and how they reached the Keystone State, no one knows, but that they are here cannot be denied, for their newly-built home has just been discovered on the farm of Judge Edinger, near Stroudsburg, in Monroe county.

"It is a genuine beaver dam, one of those marvels of ingenious construction now seldom found anywhere save in the most inaccessible parts of Canada and other northern countries.

"The presence of this dam and its builders in Pennsylvania, scarcely a hundred miles from Philadelphia, is a problem that naturalists will find hard to solve.

"All the known habits of the beaver increase the mystery. He is one of the most secretive of animals, and has but rarely been seen by human eyes, so carefully does he shun mankind. Moreover, beavers have been so persistently hunted in this country that they are likely to become extinct, and are now rare even in the remote parts of Canada.

"The discovery of the dam came through accident. John Storm, a resident of Snydersville, stumbled on to it while following a rabbit in the hills near his home. But for this chance, it might have remained hidden for years, for its cunning builders had cleverly concealed it with a protecting shield of twigs and branches.

"Visitors by the hundred, from city and countryside, have flocked to the scene, and marveled at the skill with which the little animal engineers had fashioned their strange abode.

"To all appearances, the beavers had been there for months, for the dam

was finished to the last straw, and, moreover, was abandoned, the fickle-minded beavers having already started another dam some distance away. The frost king evidently had interrupted the beavers before they had time to finish the new structure, for found it was, frozen, in an incomplete state.

"All around the stream, for a distance of half a mile on either bank, were evidences of the busy beavers' work. In one spot no less than seven trees had been felled into the stream, which flows toward the new dam, in such a way that the current would carry the supply of timber down to the builders.

"It was particularly interesting to note how cleverly the beavers selected the trees to be felled. In every case, the trees cut had been growing close to the bank in such a sloping position that the tree was sure to tumble into the water as it fell. The keen teeth had attacked the tree always on the side further from the water, so that the weight would assist the operation of felling, and send it in the direction favorable to transportation.

"Some of the trees felled were of such a size that it would seem to have been an impossibility for a beaver to haul it to the water; but with the stream as an ally, and the law of gravitation to help carry the tree to the stream, all was easy.

"It is not likely that Judge Edinger will fail to take the necessary precautions.

"'I had one fellow,' indignantly remarked the Judge to the writer, 'ask me if he could not go over there and shoot a beaver. Why, I'd almost as soon he'd shoot me. I'm going to protect the beavers, and hope they'll thrive until they are common sights along the river. One man told me I'd regret it because of the damage to the timber. Well, they're welcome to all the trees they can cut down. What are the few trees compared to a beaver dam on one's own property?'

"No one has been fortunate enough to see a member of the new colony so far. Nor is any one likely to during the winter, for when the cold weather begins the beavers retire to their winter quarters.

"Judging by the work done, the colony must number at least a score; most of the young trees growing along the stream are probably doomed, for, although work has of necessity been suspended, it evidently has not been abandoned, for newly-cut trees are lying on the ice ready for resumption of operations when the cold days give place to dam-building weather."

In confirmation of this story, Mr. Edinger writes me, from Stroudsburg, under date of Jan. 25, 1902:

"Your letter received in due course, and in reply would say that the account of the beavers on my farm, as published in the *North American* of Sunday, Dec. 15th, 1901, is correct. From the cutting of the timber done by them on my farm, I imagine they have been there for about two years, but were only discovered last fall. They have built a temporary dam about one

hundred feet in length in a swamp about one hundred yards from the stream of McMichael's creek. They are now on the bank of that stream on my property, as is seen by their late cutting of the timber. There are at least one hundred trees that have been cut by them, some quite large ones, and some cut as late as last week."

In a letter of later date Mr. Edinger gives further particulars as follows:

"Your letter of January 30th received, and in reply relative to the beaver would say that we do not know where they came from and do not know how many there are. From the cutting done by them I would imagine there may be six or eight. I have been informed there is a Park in N. J. about forty miles from N. Y. City in which there are some beavers; it may be possible these may have escaped from there. McMichael's creek, on which these beavers have located, rises in Tunkhannock township this county, flows through Chestnuthill, Hamilton, and Stroud township, through the borough of Stroudsburg and empties into Brodhead's creek. The latter empties in the Del. River at the Water Gap, three miles from this town. We have not seen any of the beavers but have tracked them by the late snow, and have located them in under the bank of the stream (McMichael's creek); they have quite a lot of wood for food at the mouth of their home, the bank is from four to six feet higher than the creek. I have put notices on the premises forbidding trespassing under full penalty of the law. I don't think that anybody will disturb them. The water in McMichael's creek at my farm and where the beavers are is about fifty feet wide and from three to five feet in depth. My farm is about two miles north of Stormsville, one mile east of Kellersville, and about one mile southeast of Snydersville. Most of the timber cut by them is swamp beech, white ash, and quaking asp. They use mostly the bark of the white ash for food."

I can see no other explanation of the presence of these beavers in McMichael's creek than the one given by Mr. Edinger. The natural waterway connection between the Allamuchy preserve and Stroudsburg would be down the Peques river to the Delaware and up that to Brodhead's creek. But this would entail almost certain destruction. A somewhat safer course would be across to the head of the Paulin's Kill and thence to the Delaware. Another route would be across the southwest border of Sussex Co. by Swartswood Lake across the Kittatinny lakes region to the Delaware, overland. Their dispersion over a similar hill and lake region in Sussex Co. northward makes this not only the safer but the most natural route.

Potter Co.—See notes under Clinton Co.

Sullivan Co.—"Jared Robinson caught 2 in the beaver dam, now called 'hay marsh,' 4 miles above Lopez between 1818 and 1820."—Behr, 1901. Query: can this be the "Jerod Robison" who "caught two or three" in the Kinzua creek region (see under McKean Co.) in 1839? It is not unlikely

that said Jared or Jerod is the guilty trapper by whose infamous pertinacity the "last beavers" of Pennsylvania were gathered to their fathers!

Sullivan and Tioga Cos.—"Nearly extinct [1834] in the Allegheny Mts." Traces of their cuttings reported seen at headwaters of Pine, Lycoming, or Loyalsock creeks.—See Taylor, London's Magazine Nat. History, 1835, vol. 8, pp. 536 to 539. "None captured or seen in Tioga Co. in my recollection of 50 years."—Cleveland, 1900.

Venango Co.—None seen or heard of in last 25 years.—Dorworth, 1900.

Wayne Co.—Beavers especially haunted the headwaters of the Lehigh and Lackawaxen. Willows, birch and poplars were their favorite building material. "The last one killed was near Honesdale. The last I ever saw was caught in a trap by Edmund Nicholson, of Salem [township]." (No dates given.)—See Goodrich, Hist. Wayne Co., 1880.

Summary of foregoing records.—It is evident that this interesting animal was practically exterminated in the eastern half of its Canadian habitat in Pa. about 1830; that some remained in the headwaters of the west branch of the Susquehanna till about 1840, and that almost the last stragglers of their race were killed in Elk, Clarion, and Centre Cos., between the years 1850 and 1865. By what means the two specimens, one said to have been killed in Clinton Co. in 1884, and the other reported seen in Cambria Co. in 1899, succeeded in evading their deadly foes, both man and beast, for the remaining third of a century we are at a loss to say, unless they were escaped importations from some part of the country.

Description of species.—It will suffice to merely indicate the racial differences between the northern and southern beavers of eastern North America. The northern animal (*canadensis*) is rather smaller and with a shorter hind foot than the southern (*carolinensis*), and the scaly portion of the tail is twice as long as its width, while in the latter the relative width is considerably greater. The upper winter fur of *canadensis* is blackish brown, the hairs tipped with chestnut, rump and thighs dark chestnut. In *carolinensis* the upper colors are hazel brown and the rump and thighs cinnamon rufous, the under parts broccoli brown, making it a much duller and paler colored animal than the Canadian beaver. The fur of the latter is long, full and soft while that of the former is much shorter and relatively harsher and thinner at the same season of year.

Measurements.—(*Canadensis*) total length, 1100 mm. (35 in.); tail vertebræ, 410 (16¼); hind foot, 175 (6¾). (*Carolinensis*) total length, 1100 (35); hind foot, 184 (7⅛); scaly part of tail, 279 x 158 (11 x 6¼).

Southeastern Beaver. *Castor canadensis carolinensis* Rhoads.

1898. *Castor canadensis carolinensis* Rhoads, Transactions American Philosoph. Society, Phila., vol. 19, p. 420.

Type locality.—Dan River, near Danbury, Stokes Co., N. Carolina.

Faunal distribution.—Austral and transition zones; Massachusetts to Florida, west to the Coast Range.

Distribution in Pa. and N. J.—This subspecies was formerly a native of all the extensive regions included in the upper austral and transition zones of the two states, supposedly intergrading into *canadensis* in the regions named above under that species.

Records in Pa.—Owing to the earlier settling up of the country inhabited by this race of beaver in Pa., I am not able to give any dates of its disappearance in that state. As one of the chief items of barter with the aborigines was beaver skins, this animal speedily was exterminated in the more accessible regions, leaving behind it only the name of creek, or river, lake, or meadow, or township, yea, even a county to perpetuate its memory. Probably Penn's colony had not been settled twenty years on the Delaware before most of the beavers of the lower Delaware, Schuylkill and Susquehanna valleys had been shipped as pelts to England. This was the condition about the year 1700. By the time of the American Revolution, 76 years more of colonization had practically wiped out the lowland beaver from all the great river valleys of the state except the northern tributaries of the Ohio. On this account, practically all contemporary history of that period was too much engrossed in the "winning of the west" to record observations on natural history, and we have hardly so much as a tradition of when and where the last valley beaver trod incautiously upon a steel trap.

Records in N. J.—Owing to the inaccessible and unproductive character of the lands of southern New Jersey, the beaver continued to exist in some of the most retired swamps of Atlantic and Cape May counties long after its brethren of the Pa. lowlands were exterminated. On this account, a few records have been found indicating its approximate disappearance. All beaver records given below dating later than 1820, we may safely include under the class of species introduced by man into our limits.—Rhoads.

Atlantic Co.—"I never saw one dead or alive" [very significant of their absence since 1830, as he was a most noted hunter in Atlantic Co. for nearly 50 years]. About 1818, a friend of his saw them swim across Great Egg Harbor River. Six old dams known to him in Atlantic Co.—2 at Hammonton, 1 three miles south of Egg Harbor City, 1 between May's Landing and Weymouth and 1 south of Doughty's Tavern.—Coffin. "In the northern part of the county, between Atsion and Batsto, the water from the main branch of the Machesautuxen was carried to the eastward through the high grounds by means of ditches or canals, into a smaller stream called Sleepy Creek, where dams were erected and where the beavers had their dwellings. . . . Higher up the same stream a series of dams were erected, flooding the whole valley for several miles and so destroying the timber that but little has grown upon

the soil, leaving it, however, a valuable pasturage for cattle during most of the year."—J. Clement, in Proceedings of the Surveyors' Association of N. J., 1880, p. 405. An examination of the map shows that this tract lies in Hammonton township at the head of the Nescochaque (Sleepy Creek?) branch of Mullica River, about midway between Hammonton and Atsion. It is named the Great Swamp. Probably the canal referred to was merely to secure access to the Machesautuxen regions rather than a source of water supply, as the tributaries of the Nescochaque reached far beyond the Great Swamp to Winslow and Cedarbrook and must have afforded abundance of water. This is probably the region of the Hammonton beaver dams, mentioned above by Coffin.—Rhoads.

Burlington Co.—"Saw lately an old dam on Wading River. Another, close by, is mentioned in an old deed to my grandfather, dated 1848. Other dams can be found on Wading River and its branches."—Price. See also under "historical notes," beyond.

Camden Co.—Exterminated in Camden Co. before 1820, one of their latest haunts in that Co. being Beaver Branch of Big Timber Creek.—Chew. Some of the beaver dams mentioned above by Clement as being built in the headwaters of the Machchesautuxen must have extended the operations of beavers into the southeastern end of Camden Co.—Rhoads.

Cape May Co.—A well-defined beaver dam may yet be traced at head of Sluice Creek, ¾ mile from South Dennis Station, Atlantic City R. R.—Hand. The last one seen near Dennisville was about 75 years (1814?) ago, but they remained near Tom's River (Ocean Co.) much later.—Miss H. L. Townsend —*fide* Lee. "It was found in Cape May Co. 25 years ago, occasionally."—Abbott, Geol. N. J., 1868, p. 757.

Mercer Co.—Dams in Crosswicks Creek yet traceable. "Was formerly very abundant, especially along the Assanpink Creek."—Abbott in Geol. N. J., 1868, p. 757, and in letter to Rhoads.

Ocean Co.—See above, under Cape May Co. Tuckerton mill dam was originally built by beavers just at high tide limit of Tuckerton Creek. It formed in the early history of that region the foundation for the first highway across the creek. A comparatively recent washout in this dam exposed the original beaver-gnawed material of its foundation.—Rhoads, *fide* Pharo.

Salem Co.—An old dam, 5 miles from Mickleton, bearing the name of Beaver Pond, is cut off from Raccoon Creek. The ancient site of the dam breast, cutting off a swampy section from the creek, is yet traceable, being held in place by the roots of many willows growing upon it.—Rhoads, 1898.

Sussex Co.—An article published in "Forest and Stream," in August, 1900, gave a detailed account of the existence of beavers in the wilds of Sussex Co by Mr. J. von Lengerke. The locality was not stated. In answer to my inquiries, under address and date of New York, February 24, 1902, I received the following interesting letter regarding these N. J. beavers:

"SAMUEL N. RHOADS, ESQ.:

"*Dear Sir:* I learn from trustworthy sources that beavers are to be found in *different* localities, especially in Sussex county, N. J. To my knowledge, there are three or four distinctly different waters which harbor them, but as to their numbers, of course, I cannot speak. In looking over the grounds where they seemed to live last year, I found but little fresh signs; it seems that the animals have worked down stream, as a mile or two below their last year's haunt lots of new fresh signs are noticeable, including a dam built under a bridge on a public country road. The water is dammed up several feet on one side of the bridge and the dam seems very effective. This road, of course, is not traveled much and there is many a day when not a single wagon crosses the bridge.

"I have not had a chance to look after the details and follow the matter up further, but expect to do so this spring and summer. There is a bill before the Legislature in New Jersey, with a view to protecting the beaver in the State, and as this is likely to pass and become a law, there would be no objection to naming the localities where the beaver are to be found. The place I refer to is near Roseville, Sussex Co., N. J. Another pond where I know beavers are to be found is Losee Pond, near Two Bridges. There are also beavers near Waterloo, N. J., and "Forest and Stream" gave a description of a solitary beaver in the Musconnetcong River.

"There are several other ponds which harbor beaver, but I have no personal knowledge thereof. Sussex county it seems harbors nearly all the animals in the State, although a few may have gotten into Morris county. Whether these animals are escaped stock I cannot say. If they are, they have done extremely well, as no beavers were introduced anywhere in that part of the State more than eight or ten years ago.

"I understand that the Messrs. Rutherford planted a few beavers in their private pond at Tranquility Farm, near Allamuchy, N. J. At any rate, beaver may be considered as belonging to the fauna of New Jersey again, and I have no doubt that, with the protection which seems now to be assured, they will do well in future.

"Yours very truly, J. VON LENGERKE.

"P. S. My waters, 'Stag Lake,' is above Roseville, and while I have no resident beavers there, I know they visited there last winter, 1900–1901."

See notes under Warren Co.

Warren Co.—"I have not seen anything of beaver in N. J. except those which have escaped from Rutherford Stuyvesant's game preserve at Allamuchy. On his reserve I noticed large trees which had been felled by these animals. They may be found along the stream [Pequest] which leads from his property."—Gifford, Feb. 4, 1901. There is little doubt that the original stock of beavers which are now spread over the southern part of Sussex Co.,

as narrated by Mr. Lengerke above, escaped from the Rutherford preserve. —Rhoads, 1902.

Historical notes, etc.—Dr. Abbott in Geology of N. J., 1868, says in general of the beaver of North N. J.: "Probably no longer found in the state, but may possibly exist in very limited numbers about the northern boundary line." This supposition, so far as it related to native or unprotected stock was probably unwarranted at that date.—Rhoads. "To the beaver-hat trade with Portugal and the West Indies, N. Jersey contributed a noteworthy share; but as the years of colonial existence drew to a close the making of beaver hats dwindled into comparative insignificance. Every effort was made to revive the beaver hat industry, but to no avail, and the commerce in this article [beaver pelts] virtually died out in pre-revolutionary times."—Lee.

Description of species.—See preceding species.

Family Muridæ, Mice and Rats.

Genus *Peromyscus* Gloger, Gemeinn. Hand. u. Hilfsbuch d. Naturgeschischte, vol. 1, p. 95.

Miller's Deer Mouse. *Peromyscus canadensis* (Miller).

1893. *Sitomys americanus canadensis* Miller, Proceedings Biological Society, Washington, vol. 8, p. 55.

1896. *Peromyscus canadensis* Bangs, Proc. Biol. Soc., Washn., vol. 10, p. 49.

Type locality.—Peterboro, Madison Co., N. York.

Faunal distribution.—Canadian and upper transition zones of eastern Canada and the United States.

Distribution in Pa. and N. J.—Not yet found in N. J., but may be discovered on High Knob, Sussex Co., or in the isolated mountain cedar swamps west of Greenwood Lake, near Passaic Co. In Pa. confined to the denser hemlock, tamarack and white pine forests of the Canadian fauna, intergrading southward along the higher Allegheny ridges of Cambria and Somerset Cos. into the small, longtailed race (?) found originally on Roan Mountain in the southern Alleghanies. See next species.

Records in Pa.—This large, forest-haunting species has been taken in its most typical form in the following localities: Clinton Co., High Mts. above Round Island, 2; Sullivan Co., Eaglesmere, 5; Lake Ganoga, 4.

Habits, etc.—Among the deep, damp, moss-covered tangle of the evergreen forests, especially where the mountain stream is darkly hid by rhododendron, Miller's deer mouse loves to dwell. He is by no means the hermit that a rambler in these solitudes might imagine, as he spies him peering out

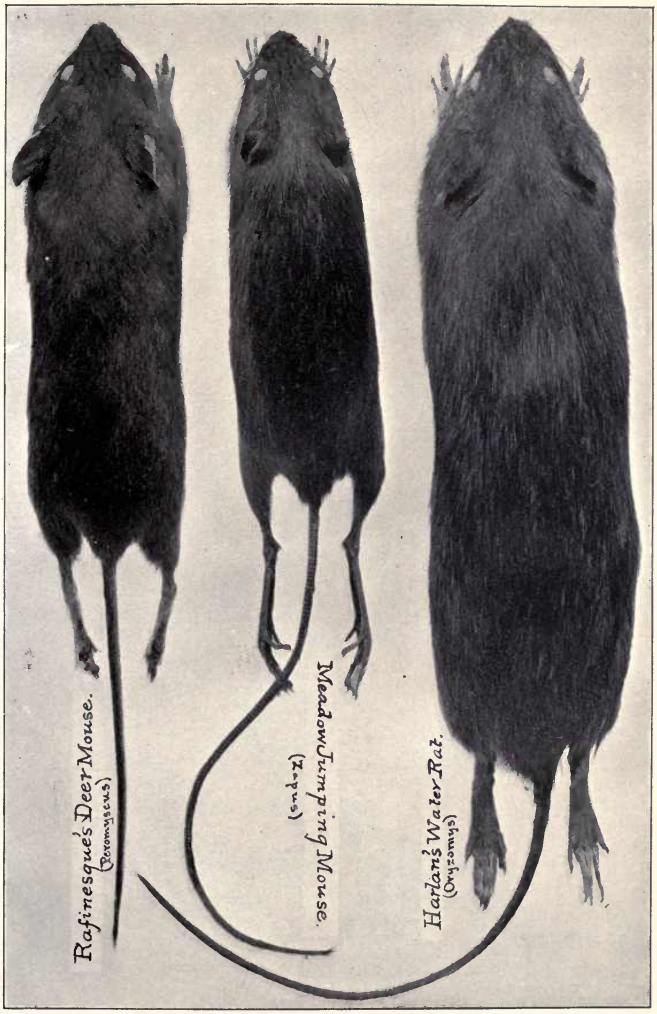
from among the hemlock roots. Stealing about among these fallen logs and beds of moss and fern, in a perfect labyrinth of passageways, are scores of his fellows, playing the tag and hide and seek of life and death with friends and enemies. These long-eared, great-eyed and bewhiskered fellows must share as best they may, the same by-ways and tunnels that form the hunting grounds of many another sort of hidden creature whose doings have so long been as a sealed book to men. Stump-tailed wood mice with rusty backs (*Evotomys*), strong-scented shrews, some fat and blood-thirsty, some so slender there's room for two to pass, a Brewer's mole or two and now and then a flash of *Zapus* fleeting by. Life is indeed not lonely here, even in the quiet daytime, but crowded, strenuous and only half suppressed. Ask the trout fisherman or the still hunter. They have some secrets yet unrevealed in books.

Except in the company he keeps there is but little difference in color and habits between the deer mouse of the Alleghanian forests and his more plebeian counterpart of the valleys. Indeed they both meet on common ground along the lower edges of the Canadian zone, daring to venture a little into each other's peculiar domain, yet never, so far as is known, interbreeding, but ever maintaining their specific characters.

Deer mice are a wonderfully large family all over this North American continent, having more species by far than any other genus of American mammals, yet they all have kept within a very narrow range of variation in size, color and habits. What I have said, therefore, of Miller's deer mouse will apply largely to all of them. In a few words, they were in measure to colonial Americans what the house mouse of the Old World now is to the super-civilized citizens of the New World, only far more beautiful and entertaining. In the lumberman's camp and settler's cabin they supply the full measure of man's need of a domestic mouse to steal his victuals, nibble his papers, nest in his boots and dance high carnival in the sheltering eaves.

A word as to that cloud-dweller which we next consider, the dusky, long-tailed sprite of the balsam woods, on the foggy peaks of the Great Smoky Mountains. Of all dark ways, his are the darkest among eastern deer mice. In consequence, all we know of him is that his looks do not belie his calling, and when we place him alongside his Adirondack ancestors, he looks as smoky as his native mountains and, strange contradiction, about a third smaller-bodied with a long, slender tail. Such, in an intermediate degree, is his half-way brother of the hemlocks at Summit Mills, in Somerset Co., near the Maryland state line.—Rhoads. "At Summit Mills, a region altogether higher than Krings in Cambria Co., *canadensis* seemed to replace *leucopus* entirely, and there I took them everywhere, in stone walls along fields, in oak and hemlock woods and one in a trap set on the mountain for cliff rats. Traps set in low, damp ground for *Evotomys* also often caught them."—Ingersoll.

Description of species.—(*Canadensis*) tail equal to or longer than head



ALL FIGURES NATURAL SIZE.

and body, heavily haired, with well-defined tuft at tip. Body above, dull, yellowish-brown, in adults; beneath, white; tail colors to correspond; feet white. In *nubiterræ*, the Cloudland race, the size is not only much smaller, but the color above is a sort of smoky brown in adults and the underparts less pure white.

Measurements.—(*Canadensis*) total length, 190 mm. (7½ in.); tail vertebræ, 100 ($3\frac{5}{16}$); hind foot, 21.5 ($\frac{13}{16}$). (*nubiterræ*), Somerset Co., average of 13 adults, 176 (7); 89 ($3\frac{1}{2}$); 21½ ($\frac{13}{16}$).

Cloudland Deer Mouse. *Peromyscus canadensis nubiterræ* (Rhoads).

1896. *Peromyscus leucopus nubiterræ* Rhoads, Proc. Acad. Nat. Sci., Phila., p. 187.

1897. *Peromyscus canadensis nubiterræ* Rhoads, Ibid., p. 213.

Type locality.—Summit of Roan Mt., Mitchell Co., North Carolina. Altitude, 6370 ft.

Faunal distribution.—Canadian or balsam forest belts of the higher southern Alleghanies, insensibly grading into *canadensis* along the middle Alleghany ridge, from southern Pa. to southern West Virginia.

Distribution in Pa. and N. J.—Not found in N. J. The most closely allied examples of Pa. *nubiterrae* that I have seen were taken in southern Somerset Co. They are more characteristic of the subspecies than of the typical form.

Habits, description of species, etc.—See under preceding species.

Specimens examined.—Cambria Co., Krings, 9; Cresson and Summit, 6. Somerset Co., Summit Mills, 20.

Rafinesque's Deer Mouse. *Peromyscus leucopus* (Rafinesque).

1818. *Musculus leucopus* Rafinesque, American Monthly Magazine, vol. 3, p. 446.

1895. *Peromyscus leucopus* Thomas, Annals and Magazine, N. History, 6th series, vol. 16, p. 192.

Type locality.—Pine Barrens of Kentucky.

Faunal distribution.—Upper austral zone, grading into the subspecies next considered (*noveboracensis*), in the transition zone. These two include practically all of the common lowland deer or white-footed mice ordinarily met with in the New England and Middle States and the Ohio Valley. Two other species somewhat overlap its range in the edge of the upper austral zone, the Golden mouse (*P. nuttalli*),* a very distinct species, and the Cotton

* A supposed specimen of *nuttalli* was recorded by Baird in his Mammals of N. America, vol. 8 of the Pacific R. R. Reports, 1857, p. 468, as coming from the Falls of Schuylkill, Pa. I agree with Coues that this must be a wrong identification. Baird also included a Carlisle, Pa. skull under this species, but there is enough variation in *leucopus* to account for a resemblance in this to one of *nuttalli*. Baird lists it after a question mark.

mouse (*P. gossypinus*), similar in appearance to Rafinesque's mouse but quite distinct in other characters, being larger. The latter does not come nearer our limits than eastern Virginia (possibly southeastern Maryland and southern Delaware), but the former has been taken in Maryland and may occasionally straggle along the eastern foothills of the Alleghany Mts. across the Pa. border.

Distribution in Pa. and N. J.—Upper austral regions of both states in universal abundance, except in southern N. J., in the pine barren and coast region, where it may be said to be rare but not absent from any place contiguous to woods or thickets. Found in its most typical form in southern N. J. merging into subspecies *noveboracensis* at elevations of about 1000 to 1500 ft.

Habits, etc.—Essentially the same as those above given for Miller's Deer Mouse. Often nesting in deserted birds' nests among thickets and briars instead of in hollow trees and logs as do the more northern forms. This animal does some damage to grain crops near woodland, carrying away and storing large quantities for so small an animal in a short time. As this is done chiefly in winter where crops have been neglected or unhoused, the fault lies less with them than with the farmer. Their chief diet is nuts, buds, bark, seeds and tuberous roots of woodland growth so that they are not to be accounted among "noxious" animals. Although so abundant they seem to rarely fall a prey to hawks and owls as compared with the meadow mice or even the shrews. This may be determined by the ratio of their skulls in the pellets regurgitated by rapacious birds. Owing to their exquisite perception of danger in all its forms and their great agility in leaping and climbing, it is probable that they likewise escape being made a very large part of the diet of weasels, foxes, skunks, etc., as compared with the more subterranean mice and shrews.

Description of species.—*P. leucopus* and its northern ally *P. l. noveboracensis* may be distinguished from the *P. canadensis* group by the relative shortness of their tails, that member being considerably less than half the entire length of the animal. In *canadensis* the tail is longer than the head and body and the prevailing color is a dull or light brownish gray, in fact very little real color about it, but in the *leucopus* group the bright and dark russet or fawn shades are a striking feature, so resembling those of a deer as to suggest the name, deer mouse. A comparison of deer mice from the lower Delaware valley with those found in the upper transition areas of Pennsylvania shows that *noveboracensis* is of a duller *grayish* russet on the back and sides, the richness of color observable in *leucopus* being dimmed by the greater amount of gray and black-tipped hairs. The darkly contrasting median dorsal area of blackish is more defined in *leucopus*, and the fur of under parts is purer white, showing less the plumbeous bases of hairs. The difference in size is

surprisingly small, in fact not appreciable in comparing ten adults from Cumberland Co., N. J., with a like series from Cambria Co., Pa., all measured by the same collector.

Measurements.—Total length, 168 mm. ($6\frac{5}{8}$); tail vertebræ, 75 ($2\frac{15}{16}$;) hind foot, 21 ($1\frac{3}{16}$); height of ear from crown, 15 ($\frac{9}{16}$).

Specimens examined.—Pa., 50. N. J., 125.

Fischer's Deer Mouse. *Peromyscus leucopus noveboracensis* (Fischer).

1829. [*Mus sylvaticus*] *noveboracensis* Fischer, Synopsis Mammalium, p. 318.

1897. *Peromyscus leucopus noveboracensis* Miller, Proceedings Boston Society N. History, vol. 28, p. 22.

Type locality.—New York.

Faunal distribution.—Transition zones and lower border of Canadian; New England to (?) Minnesota.

Distribution in Pa. and N. J.—Abundant in the transition limits of both states; meeting Miller's deer mouse and the Cloudland deer mouse on the confines of the primeval coniferous forests at a height of about 2000 feet, losing its racial distinctions from Rafinesque's deer mouse at about 1000 feet elevation.

Records in Pa. and N. J.—See under distribution.

Habits, description of species, etc.—See under preceding species of *Peromyscus.*

Specimens examined.—Pa., 138. N. J., 81.

Genus *Oryzomys* Baird, Mammals of N. America, 1857, p. 458.

Northern Rice Rat or Marsh Rat. *Oryzomys palustris* (Harlan).

1837. *Mus palustris* Harlan, Silliman's Amer. Journal Science and Arts, vol. 31, p. 386.

1857. *Oryzomys palustris* Baird, Mammals of North America, p. 459.

Type locality.—"'Fast Land,' in the vicinity of Salem," N. J.

Faunal distribution.—Brackish and salt water tide marshes of the lower and middle austral zones; Delaware Bay to Chesapeake Bay and Potomac River.

Distribution in Pa. and N. J.—Not found in Pa. Recorded originally from the marshes near Salem, N. J. Stated by trappers to be still found there. Also reported to live in the marshes of Cohansey creek near Greenwich, Cumberland Co., and recently rediscovered by Henry Warrington in the salt marshes of Cedar creek near Cedarville. The author has searched in vain for it at Salem, at the mouth of the Maurice River, at Tuckahoe and

at Tuckerton. Failure at these places may have been due to the fact that the more inaccessible tide marshes where Warrington found his specimens, were not visited. It seems best for the present to limit its N. J. range to the tidewater lands of Delaware Bay. It is found near Greenwich, Bay Side and Newtown.

Records in N. J.—Cumberland Co.—Two specimens were captured by Henry W. Warrington, Nov. 21, 1898, and presented by him to the Academy of Natural Sciences of Philadelphia. He "states that the specimens were procured on the marshes bordering Delaware Bay about midway between Port Norris and Salem, and that they were inhabiting old muskrat houses, in which they had made their nests."—Stone, Proc. Acad. Nat. Sciences, Phila., 1898, pp. 480, 481. Specimens have been secured in January the present winter and one sent to me from near Greenwich. In March, 1902, I caught several in muskrat houses on the brackish marshes of Cohansey creek, about 2 miles from the bay. I was informed that they were found at Bay Side in similar places and up Nantuxent creek as far as Newtown. No doubt the tide marshes of the entire county are tenanted by them.—Rhoads.

Salem Co.—The following is extracted from Dr. Harlan's original description of this rat: "Habitat—Found in the fresh water swamps of New Jersey and South Carolina. The present specimen was taken near 'Fast Land' in the vicinity of Salem. A similar specimen was sent to me by Dr. Bachman, of Charleston, S. C.—Cab. of A. N. S., Phila."—Harlan, Amer. Journal Sci. and Arts, vol. 31, 1837, p. 386.

In my field efforts to secure topotypes of this animal I have been unsuccessful, though informed by several muskrat trappers that they are found in the marshes of Salem creek. No doubt this is true, though the animal is by them confused with the young Norway rats found in the dikes, as evidenced by a specimen of the latter sent me for an *Oryzomys*. A letter from Josiah Wistar, an old resident of Salem, in answer to inquiry as to the meaning of "Fast Land," states "The term 'Fast Land' used by Dr. Harlan in 1836 was probably intended to distinguish what we here call upland as tillable land from marsh, or the land that has been reclaimed from the tides; so that no particular or exact locality was intended to be specified." This explanation, in view of the absence of this species in this region from upland, as conclusively proved by myself and others, leaves us as much in the dark as ever.

Historical references.—"The type of the genus *Oryzomys* was discovered by Bachman in 1816 in the marshes of South Carolina. Twenty years later he sent a specimen to Drs. Pickering and Harlan of the Academy of Natural Sciences at Philadelphia. Bachman [provisionally] named this new rodent *Arvicola oryzivora* and requested that a comparison be made between his specimen and the *Arvicola riparia* of Ord, with which he was not familiar. The comparison was made by Dr. Harlan, who incidentally found a specimen

of Bachman's new species in the Academy collection. This specimen was labeled as being taken near Fastland, near Salem, New Jersey, and Dr. Harlan, who was apparently unable to withstand the temptation of affixing his name to a new species, pigeon-holed Bachman's manuscript and himself described the New Jersey specimen, under the name *Mus palustris*. . . . In commenting on this obviously unfair treatment, Bachman states [Quadrupeds of N. America, vol. 3, 1853, p. 216] that Dr. Harlan made use of the head of the South Carolina specimen for an examination of the teeth. Harlan, however, makes no mention of Bachman's specimen beyond the brief remark just quoted [see antea, under Salem Co. records], and the type locality of *Oryzomys palustris* is, therefore, New Jersey. It is true that the type is the only specimen known to have been taken in the state, but in view of the recent discovery by Messrs. Rhoads and Stone of *Synaptomys* and *Evotomys* in southern New Jersey, we may conclude our knowledge of the mammalogy of the region may receive still further additions."—Chapman, Bulletin Amer. Mus. Nat. History, N. York, vol. 5, 1893, pp. 43, 44. See also Stone (Proc. A. N. S., sup. cit.), who goes over the same historical ground, adding remarks on the failure of Rhoads, up to that time, in rediscovering the rat in N. J. and that for various reasons the identity of the Academy specimen was becoming more doubtful and with it the right of *Oryzomys* to a place in the N. J. fauna. It should be stated that I made a careful search in 1892 for the type specimen referred to without either finding it or any entry of it in the catalogue. Harlan may have mislaid or lost the specimen, or disposed of it in a manner no less questionable than his treatment of Bachman.—Rhoads.

"The specimen in the collection of the Academy of Natural Sciences which Harlan used, was evidently without a skull and was supposed to have come from Fastland, near Salem, New Jersey. If this locality was correct, the specimen in question was probably not an *Oryzomys* at all. Anyway, Harlan used the skull of Dr. Bachman's South Carolina specimen (as positively stated by Bachman himself) in drawing up his description, and as the skull was of course the important factor in determining the new species, it seems that South Carolina must unquestionably be regarded as the type locality of *Oryzomys palustris*."—Bangs, Proceedings Boston Soc. Nat. History, vol. 28, 1898, p. 188, foot-note.

Mr. Bangs' endeavor to transfer the type locality of this species to South Carolina, in the light of the Warrington and Rhoads captures, now loses its only possible claim to recognition. His remarks as to the use of the Carolina skull by Harlan in no way invalidate Harlan's right to make, as was his intention, the Salem specimen his type, no mention being made of the source of the dental characters given in his description. Mr. Bangs' supposition that the Salem type contained no skull is not provable, and Bachman's statement that Harlan used the skull of his Carolina type in drawing up the characters

of *palustris* was only based on circumstantial evidence, so far as appears in his account of the affair.—Rhoads.

Habits, etc.—I have the following notes from a muskrat trapper near Greenwich who procured some of these water-rats for me on the tide marshes of Cohansey Creek: "Found on all tide marshes in this locality. Uses same runs as the muskrat and gets caught in the same traps. Perfect specimens hard to get, as they devour each other when fast in traps. Have seen them in nests up among the reeds but believe the nests were built by marsh wrens and confiscated by the rats. They live in holes in the big muskrat houses, which are mounds of reed and mud on our salt marshes where the tide rises and falls 5 feet. I have never seen them on the upland, but frequently found them on oyster boats tied to the banks. They will walk a line to get on board, and once there, will gnaw holes in the sails and build a nest. I think they are principally vegetarians, but when hungry will eat meat or anything that comes handy. They do not live in colonies but are scattered over the marshes. They swim like a duck but do not move about in daytime."

Mr. Bangs says of the rice-field mouse of Georgia (*Oryzomys oryzivorus* (Aud. and Bachm.)), "while perhaps preferring fresh and salt-water marshes as its abode, it is by no means confined to such places. I have caught it in dry, old fields, heavy swamps and hummocks, and even on sand hills."

Bachman says of it: "It burrows in the dykes or dams [of the Georgia rice fields] a few inches above the line of the usual rise of the water. Its burrow is seldom much beyond a foot in depth. It has a compact nest at the extremity, where it produces its young in April. There are usually 4 or 5. A singular part of the history of the rice mouse is the fact that in the extensive salt marshes along the borders of Ashley and Cooper Rivers, this species is frequently found a quarter of a mile from the dry ground. Its nest is suspended on a bunch of interlaced marsh grass. In this situation we observed one with five young. It has no disrelish to the small crustacea and mollusks that remain on the mud at the rising of the tide. In an attempt at capturing some alive, they swam so actively and dived so far from us, that the majority escaped."

In the latter part of March, 1902, I visited the Cohansey Creek marshes and secured several of this interesting species. They were only found in the tops of muskrat houses scattered over the salt marshes at the head of ordinary high tide. These houses invariably had underground connection with a tide ditch by which not only the muskrat, but other tenants of the house, viz., *Oryzomys*, *Microtus* and *Sorex*, could escape when the house was attacked from without. The runways of the water-rat and meadow-mouse often completely riddled the whole structure of the muskrat's house and descended into the marsh itself, making connection with the waterway exit of their host. When it was torn to pieces, the nests of the smaller tenants of the muskrat

ALLEGHENY CAVE RAT (*Neotoma pennsylvanica*).

Photo. from nature, size slightly reduced.

house were found to be placed just above tide level near the top of the house. They were globular and composed of fine grass, several being made in one house. All four species, musk-rat, water-rat, meadow-mouse and shrew, associated in one house, how amicably I cannot say. Newly-born meadow-mice were found in two houses. The water-rats did not take preferably to water when exposed, but endeavored to hide among the reeds and debris. Only 1 out of 15 observed was seen to dive and swim away. It swam swiftly, like a muskrat, wholly under water. During high water they were most easily caught, being loth to leave their abodes. Some were found half a mile from upland on the marsh. None were found breeding. They are considered a nuisance by muskrat trappers, as during ebb tide they prowl about the runways and "leads" of the rats and frequently spring their traps, even when under water. They also gnaw the bodies of the dead rats and mutilate their skins. When ousted from their nests, they leap about like a rat, but do not show fight as does the meadow-mouse.

*Description of species.**—The series of N. J. specimens of *Oryzomys* recently secured, shows that the typical northern animal is shorter and heavier built, with shorter tail, ears and feet and, relatively, a much larger skull than those from Georgia, the type locality of Bachman's *Oryzomys palustris oryziverus*. In color, *palustris* is lighter and grayer, the brownish tints in *oryziverus* being replaced by pale tawny. Northern North Carolina specimens are almost exactly intermediate. I would class them with *oryziverus*, making the natural geographic limit of *palustris* typicus, the Chesapeake Bay and Potomac River. I am informed they are found in muskrat houses on the Maryland peninsula. The colors of this rat are almost precisely like those of the Norway rat. The appearance of the tail is also similar, but the ears are less hairy. In adult size it equals, sometimes exceeding, a half-grown rat.

Measurements.—(Series of 6 old adults from N. J.) Total length, 237 mm.; tail vert., 108; hind foot, 29; ear from crown, 12. (Series of 3 from Georgia, Bangs' collection): 255–118–30–15. The skull of the largest N. J. male, whose total tail and body length is 15 mm. less than that of the largest male from Georgia, has a skull 1 mm. longer and 2 mm. broader than the latter.

Genus *Neotoma* Say and Ord, Journal, Academy Natural Sciences, Philada., 1825, vol. 4, p. 345.

Allegheny Cave Rat. *Neotoma pennsylvanica* Stone.

(?) 1857. *Neotoma magister* Baird, Mammals of N. America, p. 498 (described from fossil specimens in Carlisle, Pa., caves).

* See also Rhoads, American Naturalist, Aug., 1902, pp. 661–663.

1893. *Neotoma pennsylvanica* Stone, Proceedings Academy Natural Sciences, Philada., p. 16.

Type locality.—Lewis's Cave Rocks, 6 m. from Pine Grove, Cumberland Co., Pennsylvania.

Faunal distribution.—From border of lower Canadian through the transition zone. Also in isolated caves of the upper austral zone. Eastern Massachusetts to Mississippi valley; South in mountains to N. Carolina. Extremely local in its habitat, being absent from extensive regions faunally and topographically connecting the eastern and western extremes of their distribution.

Distribution in Pa. and N. J.—From records received, this native rat is found at the present day chiefly in the mountainous parts of Pa., but it occasionally descends to the cliffs and limestone caves of the great river valleys. Most diligent inquiry and field work in Pa. east of Pine Creek and Williamsport in Lycoming and Tioga Cos., and in the entire country drained by the eastern and northern branches of the Susquehanna and all of the Delaware River drainage area, has failed to locate this rat's existence in recent times. The remains of a very closely allied fossil species (see *N. magister*) have been found in Durham Cave, Bucks Co. and in Hartman's Cave, Monroe Co. in the Delaware Valley, but no living *Neotoma* now appears to exist in these places. West of the Susquehanna and Pine Creek, from York to Fayette Cos. and from the Laurel Hill range north to eastern McKean Co. and east to Tioga Co., there is a large section of middle Pa., in shape like a truncated triangle based on the Maryland line, where this species is quite uniformly distributed. No county included in this area is probably without them, but often so sparingly distributed and in such out-of-the-way places that many hunters and trappers have overlooked them entirely.

In N. J. the only locality yet known to be inhabited by them is the Bearfort Mountain south of Greenwood Lake. They have been taken on the Hudson highlands both in New York and Massachusetts, but do not appear to exist in the Palisades of N. J.

Records in Pa.—Adams Co.—"In rocky gorges in South Mountain near Graffenburg."—Strealy. Skins of two of these examined.—Rhoads.

Bedford Co.—Four specimens taken by Ingersoll at Cook's Mills.—Rhoads.

Cambria Co.—Three specimens taken near Walsall, in 1896, by Ingersoll. —Rhoads. "I have seen them in the Laurel Hill mountains near Johnstown among the rocky clefts."—Shields, 1900.

Centre Co.—"I have seen the species in Centre Co."—Warren, Poultry Book, 1897, p. 515.

Clinton Co.—Abundant in all parts of the Co.; coming down the mountains in winter into the barns along the Sinnemahoning Valley. Frequenting rock piles in the high, flat woods and cliffs and caves on the mountain sides. About fifty specimens examined from this county, from Round Island, Renovo

and Drury's Run.—Rhoads. Abundant in the rocky woods around Mill Hall. —Pfoutz.

Cumberland Co.—Lewis's Cave rocks, about 6 miles from Pine Grove furnace in South Mountain near the junction of the Adams, Franklin and Cumberland Co. lines, was the spot from which Mr. Stone's type specimens of this species were taken. I visited this locality in 1893, soon after the type had been trapped, and found it characteristic of the haunts of this rat as found in Clinton Co. No specimens were secured, but a young one was seen in this place. Their nests and rubbish indicated a long possession of this retreat. Other such retreats were noted higher up the mountain sides in two directions.—Rhoads. Specimens of the remains of a closely-allied species of cave rat from the caves near Carlisle in this Co. were made the types of Baird's *Neotoma magister*. No living representatives of *Neotoma* now inhabit these caves, or did not at the time of my visit there in 1893. As will be seen later on, I have heretofore contended that these fossil remains are of an animal specifically identical with the living species.—Rhoads.

Franklin Co.—Two taken near Graffenburg were sent me by Mr. Strealy for examination.—Rhoads.

Huntingdon Co.—"I have seen the species in Huntingdon Co."—Warren, Poultry Book, 1897, p. 515.

Juniata Co.—See Warren, ibid.

McKean Co.—Not known near Colegrove.—W. C. Dickeson. "The cave or wood-rat was a native of the mountain district in the southeastern part of McKean Co. This range of mountains divide the waters of the Allegheny and Susquehanna. I have not heard of one of these rats being caught or seen for 15 or 20 years."—C. W. Dickinson, 1900.

Monroe and Pike Cos.—"Remains of this animal [*Neotoma magister?*], both fossilized and those apparently quite recent, were taken in 1880 from Hartman's Cave, in Monroe Co., by T. D. Paret, of Stroudsburg. I have, as yet, been unable to determine whether this interesting animal is still living in that county or in Pike Co. The evidence of every sort is negative, and this after the most diligent inquiry [these remarks still hold good in 1902]. I personally explored several ledges, notably those of High Knob and the cliffs along the Delaware south of Milford without finding a trace of their existence. It is not impossible, however, that the recent habitat of this species may be traced, by isolated localities, along the Blue Ridge from South Mountain to the Hudson River Highlands."—Rhoads, Proc. Acad. Nat. Sci., Phila., 1894, p. 390.

Somerset Co.—Two specimens of "wood-rat," taken Jan. 2, 1900, near New Lexington, were presented to the Carnegie Museum by Dr. H. D. Moore. —Todd. D. G. Barclay trapped "mountain rats" 2½ miles south of Trent, and Jacob Philippi trapped them 4 miles south of Rockwood.—Moore. A specimen was taken at Summit Mills by J. C. Ingersoll in 1896.—Rhoads.

Sullivan, Lycoming, Wyoming, Lackawanna, Wayne, Luzerne, Carbon, Northampton and Lehigh Cos.—Numerous competent observers from the large area of country included by these counties agree that this rat is unknown in that region. The probability of the discovery of this rat in the Blue Ridge of Berks and Schuylkill Cos. is indicated by the following quotation from "Pennants' History of Quadrupeds," 1781, page 441, under caption of "American Rat." "Mr. Bartram [in Kalm's Trav., 1771, pp. 47, 48] mentions the rat, but does not determine the species, which lives among the stones and caverns in the Blue Mountains, far from mankind; comes out at night and makes a terrible noise, but in very severe weather keeps silent within its holes."

Tioga Co.—"Have heard of them in Tioga Co."—Cleveland, 1900.

Westmoreland Co.—I secured a specimen from Laurel Hill, about three miles above Laughlintown on the road to Jenner, in 1898.—Rhoads.

York Co.—Near York Furnace station, in the Wind Caves along the Susquehanna River, J. S. Witmer saw one alive in June, 1897. His unsolicited testimony as to the peculiar characters of this animal, contrasted with those of other rats, makes this identification reliable.—Stone. Prof. Justin Roddy of Millersville writes me he has specimens from the Wind Caves.—Rhoads, 1903.

Records in N. J.—Passaic Co.—"Soon after my arrival at Greenwood Lake, I was told by a local sportsman that he had once caught a 'wood-rat' on the nearby mountain in a dead-fall set for skunks. The summits of Greenwood [Bearfort] mountain at the south end of the lake are made up exclusively of great masses of glaciated conglomerate and shale. Chestnut and scrub oaks and dwarfed pines and hemlocks sparingly cover the nakedness of this desolate but picturesque locality. . . . After nearly two days of climbing here, I stumbled upon an escarpment from which the rock masses had so fallen into the gorge as to form a roof. Beneath this, unmistakable signs of the rats were found, and in the two following days, three specimens were trapped."—Rhoads, Proc. Acad. N. Sci., Phila., 1897, p. 28.

Warren Co.—"I was informed by a hunter at Delaware Gap that he knew of such an animal on the Kittatinny mountain in Warren Co. This statement I was unable to verify, owing to my short stay at that place."—Rhoads, Proc. Acad. N. Sci., Phila., 1897, p. 28.

Habits, etc.—The following remarks relate to a visit made in the spring of 1893 to the Lewis' Cave rocks from which Mr. J. G. Dillin secured the types of Mr. Witmer Stone's *Neotoma pennsylvanica:* "The rocks lie at the top of the mountain and form the culminating point of a rocky outcrop topping the ridge for a mile or more in this locality, and which at intervals assumes a very rugged and castellated outline. The cave rats live in the more inaccessible fissures and clefts of these rocks, selecting for their dormitories those

which are most secure from the approach or entrance of the predaceous animals which abound in such situations. The entrances and passageways to these abodes are loosely barricaded with sticks, stones, leaves, feathers, bones, horse and cow droppings, buttons, glass, tin, egg-shells, cartridge-cases, and other cast-away evidences of the sojourn of men and animals in this spot. Many of the sticks are three to four feet long and an inch in diameter, and must have required the concerted strength of several rats to move, and not a little ingenuity to convey up and over the precipitous clefts to their resting-place. The bones were those of deer, smaller carnivora, birds, and other animals brought thither by man and beast, or which had sought refuge among the clefts to die. I was unable, from the nature of their fastnesses, and lack of time and proper implements, to penetrate their dormitories, and owing to the pilfering foxes, lost the only specimens that got into my traps. One half-grown rat was seen running among the rocks. It was lighter gray than adult specimens. Quantities of gnawed acorn hulls strewed their hiding places, and were the chief evidences of the diet of this species. These acorns grow abundantly on the scrub oaks, *Quercus banisteri*, characteristic of these mountain tops. While its main food supply is vegetable, no doubt these rats are omnivorous, and take every opportunity to satisfy their carnivorous appetite. The gnawed condition of the bones of recent mammalia found in Pennsylvania cave deposits, is to my mind almost solely due to the work of this quadruped, a critical examination of these marks showing not only their rodent origin, but that their size and character fit no tooth so well as that of *magister*.

"I am informed by Mr. H. C. Mercer (whose recent explorations of Virginia caves have been ably outlined in a Bulletin of the University of Pennsylvania, dated July 4, 1894) that the Virginia cave rats build a sub-globular nest of grass, etc., on the cave floor, and that these are so well made internally as to resist considerable kicking about. Prof. E. D. Cope, who secured the two specimens of *magister* tabulated above, from a cave in Wythe Co., Virginia, tells me that these nests are placed at or near the sides of the cave, and are often large enough to fill a bushel basket."—Rhoads, Proc. Acad. N. Sci., 1894, pp. 219, 220.

"My experience with the cave rat in Kentucky is confined to an unsuccessful attempt to capture them in Mammoth Cave during a visit there in April, 1895, in company with Professor R. E. Call. At that time I examined their rendezvous and conversed with some of the guides concerning them. Subsequently I received alive an adult male specimen, and studied the habits of the animal in captivity for nearly a month before sacrificing its life to science.

The only place where I noted evidences of this animal in Mammoth Cave was about a quarter of a mile from the entrance, in the wide passageway known as The Main Cave.

Piles of loose stones line the sides of the cavern at this point, and along the foot of the arching walls are strewn the indescribable collection of materials with which this animal is sure to adorn and litter its by-ways. Among these were found the nuts and seeds of various trees and plants growing around the mouth of the cave, showing unmistakably the chief source of their food supply, and that they by no means confine their wanderings to the cave itself. I was unable to find the nests or remains of the rats, but the numberless narrow passageways, stone heaps, and crevices undoubtedly concealed these from search as well as the live animals. Of their numbers it was impossible to get information. The guides rarely see them, and their haunts seem to be largely confined to the particular locality I have mentioned. No instance had come to their (the guides') notice of the rats building a nest openly on the floor of the cave, as has been stated to be the custom of the same species in the caves of Virginia.

The rat from Mammoth Cave, which I kept alive, was so precisely a duplicate, both in appearance and actions, of one I had previously studied and which came from Clinton County, Pennsylvania, that the thought of their being different species or races could not be entertained, and the examination of their anatomy confirms such a negative view.

Any suspicion of blindness or deficient eyesight, such as is exemplified in some of the lower orders of animal life in the cave, cannot attach to this mammal. As in all the more strictly nocturnal rodents, the eyes of this species are greatly developed; nevertheless, they are able to make most intelligent use of them in broad daylight, if need be. My pet cave rat was very sleepy in the daytime, and if given the materials would quickly make a globular nest in which to hide. The favorite position of rest was on the side, coiled, with the nose resting on the abdomen and tail curled around the body. It frequently would "sit on its head," as it were, by leaning forward and placing its nose near the root of the tail, that member acting as a sort of prop to prevent the animal from turning a somersault in its sleep. Sometimes it would lie stretched out at full length on its side, the tail straight and the hind feet extended to their farthest limit. It invariably picked up objects with its teeth, though its fore-feet were quite capable of the service, and the dexterity with which it would manipulate a nut with one or both paws was astonishing. In eating this kind of food it would quickly rasp a small hole, and, inserting the long lower incisors, clip off pieces of the kernel and extract them with great adroitness through an opening less than a quarter of an inch in diameter. All kinds of vegetable and animal food were acceptable to it, but it seemed to prefer nuts and grain to anything else, though cabbage and apples were a favorite dessert, and it greatly enjoyed sharpening its teeth on candy toys. It was a great drinker, lapping water like a dog. In defending itself it would stand on its hind legs and strike with great force with the fore

feet, at the same time laying hold on an object thrust toward it with great strength and forcing it toward a distant part of the cage. The odor of this animal, even under ordinary conditions of care, is almost suffocating, and far more mephitic than that of the Norway rat. When investigating an object, the coarse and prominent whiskers of this rat are vibrated with astonishing rapidity, forming a sort of halo about the face because of their incessant motion. The function of these organs must be highly specialized in this *Neotoma*, and undoubtedly has to do with its subterranean habits. On no occasion did any of my caged rats utter a cry, save a sort of grunting squeak when they yawned forcibly."—Rhoads, Journ. Cincinnati Soc. Nat. Hist., vol. 19, 1897, pp. 54 to 56.

A nest of this species found in a small cavern near the crest of the mountain at the sources of Cook's Run, Clinton Co., was set among loose boulders at the hinder end of the cavern and was composed externally of oak leaves, small branches, sticks and moss. Within this mass, which would nearly fill a half bushel measure, the nest proper was composed of grass and long strippings of inner bark of chestnut and hemlock in a spherical form, with a single entrance, so far as could be discovered, the nest being much damaged in extricating it. It is now on exhibition at the Academy of Natural Sciences, Philadelphia.

Owing to its preference for uninhabited localities, this rat rarely enters into economic relations to men. It sometimes makes its home in the outbuildings or humble cabins of the wilderness settlers when they happen to locate near the hiding places of this animal. In such instances they are both mischievous and destructive, hiding away much more than they devour. Like the camp rat or pack rat of the Rocky Mountains, they are, to some extent, a nuisance to hunters, lumbermen and miners during their temporary sojourn in the wilderness haunts of this species, but any permanent inroads of civilization into their territory result in their speedy extermination. They appear to defy the encroachments of the Old World rats, *M. rattus* and *M. norvegicus*, when they come in contact.

Description of species.—For the benefit of those who are unable to look up the literature to which references have been made concerning the relations of *N. pennsylvanica* and *N. magister*, it may be stated that Professor Baird's name of *Neotoma magister* for this rat was originally applied to what he considered a fossil species, described from some lower maxillaries taken in a cave near Carlisle, Pennsylvania. Similar remains were afterward found in other caves, but it was not till 1893 that Mr. Witmer Stone announced the discovery of a living *Neotoma* in the South Mountain, not many miles distant from the Carlisle cavern which produced Baird's types. To this animal Mr. Stone gave the name *Neotoma pennsylvanica*. Not long after, I made a comparison of the remains of the extinct(?) rat with Mr. Stone's types, and in "A Contribu-

tion to the Life History of the Allegheny Cave Rat" (l. c.), endeavored to show that the living and so-called "fossil" *Neotomæ* were specifically the same. In his Review of the *Neotomyinæ* (l. c.), Dr. Merriam considers them distinct, but Dr. J. A. Allen, in a recent paper, inclines to the belief that they are identical. Dr. E. A. Mearns and G. S. Miller, Jr., now (Bull. Amer. Mus. N. History, 1898, pp. 334, 335, and Bull. N. York State Mus., 1899, p. 318) agree that the fossil and recent species are distinct, having compared Baird's types with skulls of *pennsylvanica*. The differences pointed out by Mearns consist in the relatively shorter, stouter mandible and dentition of *magister*. I have recently examined this scanty material with Mr. Stone, and find that, so far as it goes, Mearns' remarks are germane, though these differences amount to only 1 millimeter in mandibular length and breadth, the tooth row of *magister* being of the same length and about a hair's breadth wider.

The general characters of *pennsylvanica* resemble, in a degree, those of the common, or Norway rat, *Mus norvegicus* (*decumanus* of authors), but distinguished by greater size, much larger ears and eyes, thicker, shorter and much more hairy bicolored tail, white feet and under parts, dark upper parts and the heavy whiskers. The skull is instantly recognized by its great size, long rostrum, lack of supraorbital ridges and the flat, prismatic-crowned molar teeth. The cave rat is distinguished from the southern wood-rat, *Neotoma floridana*, its nearest geographic ally, by greater size, more hairy and bicolored tail and grayer (less brown) color above; also by the blackish areas around eyes and at bases of whiskers. The color of *pennsylvanica* above is a uniform tawny or buffy-gray (in some a sort of iron-gray), lined plentifully with coarser and longer black-tipped hairs. Along sides, the buffy predominates, becoming white on under parts and feet, but reaching nearly across the fore part of breast. Ears meeting when laid across top of head. Whiskers reaching to or behind shoulders. Tail with upper half darker than back, lower half white, the hairs long and somewhat depressed along sides. Greatest length of skull twice its greatest breadth.

Measurements.—Total length (average of 5 adults from Somerset and Cambria Cos.), 421 mm. ($16\frac{9}{16}$ in.); tail vertebræ, 193 ($7\frac{5}{8}$); hind foot, 43 ($1\frac{11}{16}$); ear, from crown of head, 28 ($1\frac{1}{8}$). Skull: greatest length, 56 ($2\frac{3}{16}$); greatest breadth, 28 ($1\frac{1}{2}$).

Genus *Evotomys* Coues, Proceedings Academy Natural Sciences, Phila., 1874, p. 186.

Gapper's Wood Vole, or **Red-back Mouse.** *Evotomys gapperi* (Vigors).

1830. *Arvicola gapperi* Vigors, Zoölogical Journal, vol. 5, p. 204.
1891. *E.*[*votomys*] *gapperi* Merriam, North American Fauna, No. 5, p. 119.

Type locality.—Vicinity of Lake Simcoe, Ontario, Canada.

Faunal distribution.—Typical *gapperi* is restricted to the forests of the Canadian and transition zones from Quebec to central Pa., and from the Atlantic Ocean to Dakota.

Distribution in Pa. and N. J.—Abundant in the upper transition and Canadian regions of Pa., but becoming local and sparingly found in the lower transition areas. Grading toward *E. g. carolinensis* in mountains of southern Pa. In N. J. it is nowhere abundant, living only in isolated spots in the Kittatinny, Walkill, Bearfort and Ramapo mountains. In southern N. J. a darker race is found in the cedar swamps and wooded bogs which there abound. This has been named by my friend Mr. Stone, *Evotomys g. rhoadsi.*

Records in Pa.—See list of specimens examined, below.

Records in N. J.—Passaic Co.—I am convinced that the reason this species was not taken near Greenwood Lake was my neglect to set traps in the white cedar swamps, some of which were seen on the mountain top near Lake Waywayanda. They were found in less likely situations in the Walkill Valley.—Rhoads, 1896.

Sussex Co.—"Thirteen specimens were trapped in and about Bear Swamp, near Long Lake, and six more in a hemlock swamp in the bottoms of the Walkill, about 2 miles south of the N. York state line."—Rhoads, Proc. Acad. Nat. Sci., Phila., 1897, p. 27.

Warren Co.—It is doubtful if this vole is found as far south as Warren Co., even in the mountains, unless it be that an exploration of the Allamuchy region reveals it. I failed to secure it near Delaware Gap.—Rhoads, 1902.

Habits, etc.—What I have written regarding the ways and haunts of Miller's deer mouse applies largely to this dusky, short-tailed dweller of the forests. He takes the place of the common meadow mouse in our cool forests and swamps, rerely venturing far out of the woodland shades to meet this larger kinsman on the skirts of swamps and meadows. In fact the meadow mouse makes nearly all the advances along this line, no doubt to the disgust of the wood mouse, whose cool runways he invades. *Evotomys* seems to prefer well-shaded, swampy, damp places, where he can often wet his feet in underground paths and dive through the hidden pools of water. He lives on the leaves and tender stems of many weeds and grasses and also enjoys the nuts and seeds of several species of trees, especially beechnuts, chestnuts, hazlenuts and acorns, for which it frequently makes excursions into the dry upland forests and hill tops. It also seems to be fond of certain shelled snails, as *Omphalina* and smaller *Polygyra*, these being found in the retreats where the mice are trapped. They secure the snail by gnawing a hole into the apex of the shell and drawing the body out backward. In winter I have found that they live almost entirely on the leaves of the evergreen strawberry bush, *Euonymus americanus*, which grows abundantly in the cedar swamps and

damp hemlock forests. As we approach the lower transition confines of its range, this vole is much more restricted in its wanderings, rarely leaving the sphagnum-covered bogs and stream banks which are most densely shaded by evergreens. In such places I have found their burrows forming such a perfect network through the moss that scarce a foot of sphagnum could be found without one or more of them, rarely coming to the surface but mostly running along at or below the level of the hidden springs which feed the swamp.

This mouse rarely enters dwellings of any sort and is one of the most inoffensive of its genus, economically speaking. It forms a large part of the prey of some rapacious animals, especially the Bonaparte's Weasel, *Putorius cicognani*, seeming to be more unsuspicious than other forest-dwelling mice and less agile in escaping attack. It often runs about and searches food in open daylight, climbing up the stems of *Euonymus* to cut off a supply of leaves or peering out at a human intruder from the mouth of its burrow, or making a dash across the open hotly pursued by a voracious, short-tailed shrew or quarrelsome deer mouse.

Description of species, etc.—See under next species.

Specimens examined.—Pa.: Sullivan Co., 26; Clinton Co., 10; Westmoreland Co., 3; Monroe Co., 6; Somerset Co., 23; Potter Co. and McKean Co., several; Susquehanna Co., 2. N. J.: Sussex Co., 2 localities, 19.

New Jersey Wood Vole, or **Red-back Mouse.** *Evotomys gapperi rhoadsi* Stone.

1893. *Evotomys gapperi rhoadsi* Stone, American Naturalist, vol. 27, p. 55.

Type locality.—May's Landing, Atlantic County, N. J.

Faunal distribution.—Transition islands of the upper austral zone in New Jersey. Probably also to be found in similar places in Maryland and Delaware.

Distribution in Pa. and N. J.—Not found in Pa. So far as I have explored the typical white cedar swamps of New Jersey and done persistent trapping therein, I have found this vole. This work covers parts of Atlantic, Burlington, Camden, Cape May and Cumberland Cos. The most northerly point of finding it was in the edge of a bog near Medford, in Burlington Co., the most westerly and southerly, in swamps 3 miles west of Port Norris, Cumberland Co. There are a few small isolated swamps of white cedar (*Chamæcyparis*) near the Delaware river, in Camden and Gloucester Cos., where I have briefly trapped for them without success but have no doubt, from the character of the regions and of the runways in these swamps, that *Evotomys* was there in small numbers. The taking of them near Medford is the first instance of any being found in the Delaware river drainage, north of Delaware Bay. From what we now know of the peculiar haunts and distribution of this race, it is

reasonable to extend their habitat northward and eastward in N. J., in conformity to the distribution of *Chamæcyparis* swamps, through eastern Monmouth and Middlesex to Hudson Co. At what point they may be said to intergrade with *gapperi* we have not the material to show, but the Pine Barren regions south of Monmouth Co. are probably their most natural limit.

Habits, etc.—What has already been written regarding Gapper's wood vole will apply largely to the habits of this race. The cedar swamp vole, however, living as it does in a faunal region where the hot climate and vegetation of the uplands immediately adjoining the swamps it frequents is injurious to so boreal an animal, keeps very close to the damp, cool interior and boggy margins of the swamp where the sphagnum is always dense and moist or the cedar hummocks crowd closely together. Such an environment, permitting no incursions into the sunnier uplands and requiring close contact with the subterranean springs which make life bearable in summer in such austral surroundings, has probably been the cause of the darker coloration of this vole, as compared with Gapper's vole of the north woods. From remarks made in the original descriptions of it, there seems to be an idea that the cedar swamp race is partial to cranberry bogs. This is not the case, they rarely venturing into the edges of the open bogs farther than the line of bushes which fringes the borders of the cedar swamp. In the open bogs they are replaced by the meadow mouse, *Microtus pennsylvanicus*.

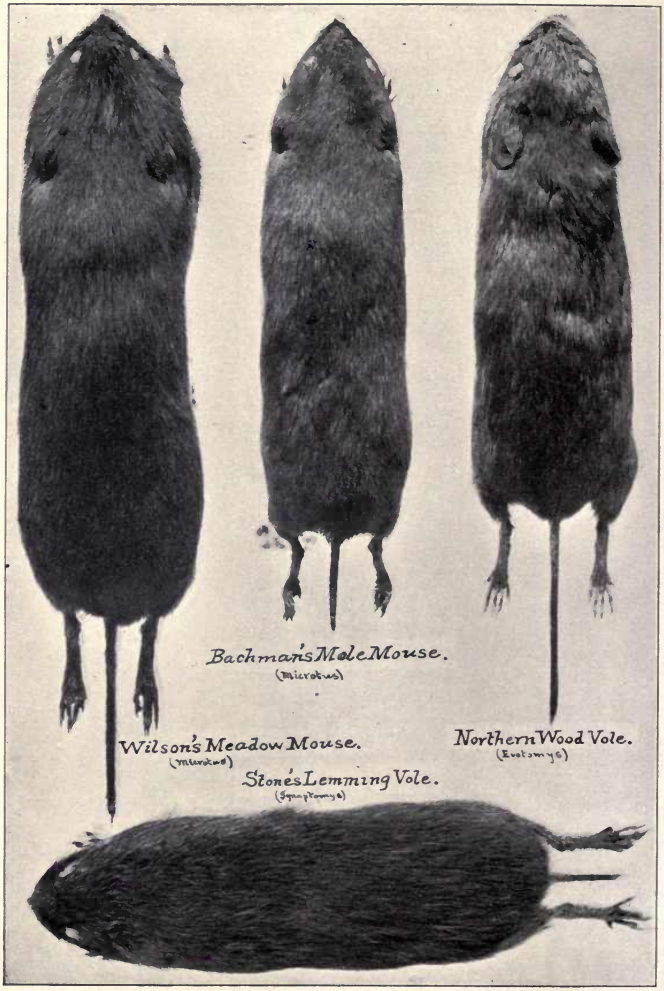
Description of species: Gapper's wood vole is bright chestnut on the back, sprinkled lightly with blackish hairs; sides grayish-buffy ochraceous; belly gray, washed with pale buff, the lateral line separating the upper and lower colors not defined, the grayish-buff reaching far up the sides, restricting the chestnut dorsal area to a sort of broad stripe; feet above, grayish-white. Ears showing above body fur. The New Jersey wood vole is dark chestnut above, thickly mingled with blackish hairs over back, head and sides, underparts as in *gapperi*, hind feet dusky gray, upper body colors reaching down sides and definitely separated along the ground line from whitish of under parts.

G. S. Miller, Jr., in his key to Land Mammals of N. Amer., 1900, p. 111, separates these two forms as distinct species on a basis of the cranial characters and of the size of the ears and sharp definition between upper and lower body-colors. I have taken a large series of adult *Evotomys* from, 1, southern N. J., 2, northern N. J., 3, North Mountain, Pa., 4, Quebec, and 6, southern Pa. and W. Va., and compared them with the following results: 1, there is practically no difference in average measurements in the four series, the size and character of ear not being diagnostic; 2, the color differences are not sufficient of themselves to admit of more than racial separation; 3, the cranial characters ("skull and teeth much heavier than in *E. gapperi*, in this respect resembling *E. carolinensis*") appear to show constant difference in respect

of the folding of the enamel in the second and third anterior triangles of the first upper molar. In nearly all the southern N. J. specimens of *rhoadsi* these triangles are not complete but are confluent; the molar triangles are also more flattened and wider, in relation to the length of the teeth, than in *gapperi* from northern latitudes. But these characters have exceptions, a skull from the Walkill valley being exactly of this *rhoadsi* pattern and a topotype of *rhoadsi* from May's Landing having the angles closed as in *gapperi*. As regards size of skull, in the southern animal it does not grow as long as, but is relatively a little wider than, *gapperi*. Specimens from Sussex Co., N. J., are intermediates in this respect, however. From the anatomical standpoint, therefore, we lack the necessary evidence to consider *gapperi* and *rhoadsi* distinct species. Geographically they have been supposed to be widely separated, but, as I have previously shown, the gap which originally seemed to exist has been narrowed by absolute research so much that our botanical knowledge of the rest of the country seems likely to span the remainder.

In this connection, I would remark that the suggestion made by Mr. Miller, regarding the relationships of N. J. wood voles to the species *carolinensis* inhabiting the balsam belts of the higher southern Alleghenies of North Carolina, is most pertinent. My series of 22 specimens from Summit Mills, southern Somerset Co., Pa., shows remarkably close approach to all the distinguishing characters of size given by Bailey (Proc. Biol. Society, Washn., 1897, p. 130) to separate *carolinensis* specifically from *gapperi*. In regard to color, the Somerset Co. specimens are more like *gapperi*. The largest adults of these measure as follows, in millimeters (Bailey's similar measurements of *carolinensis* following each in brackets): Total length, 148 (149); tail vertebræ, 41 (44); hind foot, 20 (20.2); ear, 11; basal length of skull, 22.8 (23.5); nasals, 7.8 (7.5); zygomatic breadth, 14.5 (14.4); alveolar length of upper molar series, 5.5 (6). Specimens from West Virginia and from Cambria Co., Pa., complete the links in an unbroken chain which connect *gapperi* of northern Pa. and New York with his larger and darker kinsman, *e. g.*, *carolinensis*, of the Great Smoky Mountains, in much the same manner as has already been pointed out in my remarks on Miller's deer mouse and the Cloudland deer mouse of the same regions. Taking Canadian *gapperi* as the parent stock, we thus have two darker and larger off-shoots projected southward into the austral zone, one by virtue of the moist, boreal, lowland climate of cedar swamps, the other on account of a similar environment resulting from an elevation of 6,000 feet above the sea, amid the moisture-laden winds of both sea and land.

Measurements of species.—These body measurements apply alike to *gapperi* and *g. rhoadsi*. Total length, 140 mm. ($5\frac{1}{2}$ in.); tail vertebræ, 40 ($1\frac{9}{16}$); hind foot, 19 ($\frac{3}{4}$); ear, from crown, 11 ($\frac{7}{16}$). In *rhoadsi* the skull is not materially larger than *gapperi* but the tooth rows are about $\frac{1}{4}$ of a millimeter



ALL FIGURES NATURAL SIZE.

longer and relatively wider, with flattened, less rounded, angulation of the enamel folds. The hind foot of *gapperi* averages 1½ mm. shorter than in *rhoadsi*.

Specimens examined.—Atlantic Co., May's Landing, 8; Burlington Co., Bear Swamp, near Medford, 3; Camden Co., Ancora, 3; Cape May Co., Tuckahoe, 7; Cumberland Co., near Port Norris, 7; Mauricetown, 5.

Genus *Microtus* Schrank, Fauna Boica, 1798, vol. 1, p. 72.

Pennsylvania Meadow Vole, or **Common Meadow Mouse.** *Microtus pennsylvanicus* (Ord).

1815. *Mus pennsylvanicus* Ord, Guthrie's Geography, 2d Amer. Edition, vol. 2, p. 292.

1895. *M.* [*icrotus*] *pennsylvanicus* Rhoads, American Naturalist, vol. 29, p. 940.

Type locality.—Meadows below Philadelphia, Pennsylvania. Probably on "The Neck."

Faunal distribution.—Abundant in neglected fields and marshes and along borders of woodland in the lower Canadian, transition and upper austral zones; Atlantic Ocean and Mississippi Valley, St. Lawrence Valley and Great Lakes to Virginia and the Ohio Valley.

Distribution in Pa. and N. J.—Cosmopolitan in all open situations beyond the forest confines, in both states.

Habits, History, etc.—This species is apparently so abundant and its habitat so much less concealed than that of our other small mammals it is by far the best known, in a popular sense, of any. There are, however, many mistaken ideas current about this species, even among so-called students of nature and scientific observers. Especially is this the case in regard to its economic status. In order to bring this subject to public notice, I published the results of my field observations made during several years' study of this mouse, both as a farmer and as a collector of specimens for scientific purposes. The publications referred to are summed up in an article in the "American Naturalist," of August, 1898, pp. 571 to 581. From this I will make the following extracts:

"Let us take the most flagrant case of a so-called noxious mammal, one which forms the bulk of the food of several of our hawks and owls which are nowadays rightly classed as the farmer's friends. The common vole, or meadow mouse (*Microtus pennsylvanicus*), belonging to the same subfamily of rodents as the northern lemming, is rated by nearly all who know him as the incarnation of agricultural pests. On this standard, and this alone, have Drs. Warren, Fisher, and Merriam based their verdict of the economic value

of nearly two-thirds of the eastern species of hawks and owls which appear on their rolls of honor. The rough-leg hawk is accorded first place on this list because he eats almost nothing else but meadow mice of this species. But it is a stubborn fact that the case of the meadow mouse has never been proved against him. Not a tithe of the study devoted to his devourers has been given to him, and no scientific analysis of his stomach contents or food habits has yet been put on record. His plea of '*not guilty*' stands good so far as the records of economic zoölogy are concerned. This may sound preposterous to every reader of the statement, but it is undeniable, and not more difficult to believe, after we have inquired into the facts of the case, than the conclusions of the modern zoölogist regarding some of our hawks and owls. 'Of course, meadow mice live almost wholly on vegetable food, the grasses and grains of the farm, and that settles it.' So retort the great majority, and until a very recent period the writer had thoughtlessly been one of that number. As a farmer, I have had ten years' acquaintance with the habits of the meadow mouse in Pennsylvania and New Jersey, and as a zoölogist, have made about six years' study of the same animal in ten eastern states. In that time about a thousand specimens have been secured and examined, and four hundred preserved for study. Without going into details, the following is a summary of my conclusions as to the economic status of this species, the common meadow mouse, *Microtus pennsylvanicus* of Ord:

"1. From 90 to 100 per cent. of the food of this mouse throughout the year is vegetable, of which 60 to 80 per cent. consists of endogenous plants, chiefly grasses; 15 to 30 per cent. consists of exogenous plants, chiefly weeds; 5 to 10 per cent. consists of tubers and roots; and 1 to 5 per cent. consists of grain and seeds.

"2. From 1 to 5 per cent. of its diet consists of animal matter such as other meadow mice, and the remains of dead animals.

"3. Its vegetable food the year round is largely made up of 'grasses,' popularly so called, and during the summer season several species of native and introduced weeds form a considerable share of its diet.

"4. Its destruction of grasses at all seasons is confined largely, and in the majority of cases almost exclusively, to the rushes (*Juncus*), sedges (*Carex*), salt grass (*Spartina*), Indian grass (*Andropogon*), and other coarse forms which have little or no agricultural value and are rejected by stock either as hay or pasturage.

"5. 70 to 80 per cent. of the whole number of meadow mice in any given area restrict their habitat to low, moist soils, bogs, and clearings, which are classed by the farmer as waste land or untillable meadow, and in these situations they consume almost nothing which would be utilized by the husbandman.

"6. 20 to 30 per cent. are found on upland soils. Of these, nearly all

confine their foraging to neglected fence rows, abandoned fields, weed patches, brush piles, rubbish, and litter, caused by that clog to American civilization, the shiftless farmer. In these situations the meadow mouse destroys nothing, but utilizes a great deal which otherwise would cumber the ground.

"7. The arable land of every well-kept and cultivated farm or nursery, whether in pasture, grass, grain, orchard, truck, or young trees, is practically deserted by this mouse. In short, it can only exist where a food supply is found in conjunction with proper shelter, a shelter in almost every instance synonymous with neglect and waste on the part of the farmer and of utility on the part of the mouse.

"8. The meadow mouse rarely eats grain except when the rigors of exceptional winters deprive it of green food. It then confines its appetite to what is found on or in the ground, and which has been exposed by the farmer's improvidence. It very rarely disturbs seeds, fruits, tubers, roots, or vegetables during the growing season, and does little damage in winter to those buried in the ground, most of the ravages in these cases being the work of the short-tailed meadow mouse (*Microtus pinetorum*) and the white-footed mouse (*Peromyscus leucopus*).

"9. On upland soils the meadow mouse is a surface feeder, forming its runways almost entirely above ground in the shelter of surrounding vegetation and débris. The burrowing of this species is confined chiefly to easily worked, moist lowlands, where it conduces largely to better drainage and an increase of vegetable growth.

"To summarize the case briefly, it may be truly said that as a converter of waste vegetable matter into flesh-food for bird and beast the common meadow mouse has no rival in the regions it inhabits. Besides the numerous species of hawks and owls depending almost entirely on this mouse, other carnivorous birds, as the crow, jay, shrike and heron, devour a great many. It forms a large part of the menu of several of our mammals, as the wild cat, house cat, fox, marten, weasel, mink, raccoon, skunk, and opossum. The larger species of snakes, the bullfrog, and some of the turtles, also devour them. Strike the meadow mouse from the food list of the tens of thousands of animals which devour him in the eastern United States, and the problems of the economic zoölogist would multiply an hundred fold.

"The worst charges proved against him are: (*a*) the undermining and tunneling of artificial water barriers; (*b*) the destruction of a small amount of grain and vegetables not seasonably harvested or housed; (*c*) the consumption of a very small percentage of grasses which would have been utilized by the farmer; (*d*) the gnawing of the bark of fruit trees in severe winter weather.* The insignificance of these items compared with the value

* Dr. A. K. Fisher, in a recent answer to my inquiries regarding the possible economic

of the mouse as a tiller of the soil, a destroyer of weeds, utilizer of otherwise useless grasses, and a food supply for two-thirds of our carnivorous birds, mammals, and reptiles, is apparent. Exterminate the mouse, and the changed food relations resulting therefrom would cause the extermination of many most beneficial animals and the conversion of others into pests to the greatest detriment of agriculture. Let us not forget, on the other hand, that any marked decrease of the animals which prey on the meadow mouse is equally to be deprecated, attended as it might be with similar consequences to the 'vole plagues' of the old world. To maintain the balance of power between these neutralizing agencies, in the changed conditions imposed by advancing civilization, is the real province of economic natural science."

In the above extract, only casual reference is made to the destructive pine vole, or short-tailed, underground, mole-like cousin of the meadow mouse. This species, whose vices are almost universally charged to the meadow mouse and the mole, will be more fully treated beyond.

The meadow mouse makes its nest *on the surface* of the ground in uplands where grass or débris lie thickest, forming it wholly of fine grasses in a globular form, with two exits on the under side. In swampy ground, they place it in the top of a dense tussock out of reach of ordinary flood or tide. In the salt marshes of the coast they are so excessively abundant that by stamping about vigorously on the grassy margins of the pools they may be driven into the water, diving and swimming with great agility to the farther side, and so escaping. They greatly enjoy feasting upon the trapped carcasses of their fellows. or of other mice, in the winter season when snow covers their more natural food. I have found that they do this in summer occasionally.

The history of the naming of this mouse has more than a local interest. In the earlier edition of Alexander Wilson's Ornithology it is figured and a description given (vol. 6, p. 59), based on specimens observed near Philadelphia, either on "The Neck" meadows or on those near Bartram's Garden, along the Schuylkill, a place then frequented by Wilson. George Ord, the subsequent editor of Wilson's completed Ornithology and one of the early presidents of the Academy of Natural Sciences of Philadelphia, made Wilson's description of this meadow mouse the basis of his name, *Mus pennsylvanica*, which was published in 1815 in the second American edition of Guthrie's Geography. This work had become so nearly extinct in the next 50 years tnat authors had adopted Ord's subsequent name for the same species, *Arvicola riparius*. In November, 1893, I discovered a copy of this long-lost edition of Guthrie's Geography and published a reprint of the part contrib-

value of the meadow mouse, denies that it is anything but a pest, and states that its destruction of trees in nurseries is alone sufficient to condemn it. I have since corresponded with two prominent Pennsylvania nurserymen, Mr. Thomas Meehan and the Wm. H. Moon Co., both of whom deny that they have suffered by this mouse to any extent.

uted by Ord. So far as is known, this copy of Guthrie's work is the only one extant. An author's separate is in the Acad. Nat. Sci., Phila.

Description of species.—Wilson's meadow mouse varies slightly in size and coloration within our limits, specimens from the salt marshes of southern N. J. being larger and grayer than those from the mountain tops of northern Pa. Those in the latter region approach somewhat the characters of the northern meadow vole, *M. p. fontigenus* (Bangs), which is restricted to the Hudsonian zone. There seems to be no approach in our Pa. & N. J. specimens to the southeastern race, *M. p. nigrans* Rhoads, found in the region of Dismal Swamp, Virginia. In the mountains of central Pa., Mr. Ingersoll found a peculiar phase of coloration in this species, many specimens being "of two shades of umber-brown over the whole of upper parts, two from Tuscarora being almost a deep blackish-chestnut."

The general color of this species, above, is a tawny gray-brown; beneath, light gray washed with buff; tail colors corresponding with those of body, feet dark gray. The young are much darker, plumbeous-gray. The upper incisors or cutting teeth are smooth-faced, not grooved. The tail is over ⅓ the length of head and body. Ears not showing above body fur.

Measurements.—Total length, 138 mm. (5½ in.); tail vertebræ, 38 (1½); hind foot, 19 (¾).

Specimens examined.—Pa., 16 counties, 255; N. J., 13 counties, about 300.

Northern Pine-woods Vole, or **Mole Mouse.** *Microtus pinetorum scalopsoides* (Audubon and Bachman.)

1841. *Arvicola scalopsoides* Audubon and Bachman, Proc. Acad. Nat. Sciences, Phila., vol. 1, p. 97.

1896. *Microtus pinetorum scalopsoides* Batchelder, Proceedings Boston Society Nat. History, vol. 27, p. 187.

Type locality.—Long Island, New York.

Faunal distribution.—Abounding in sandy, loamy soils, both forested and deforested, in the upper austral zone; more sparingly found in the transition zone, up to the summits of the higher Pa. Alleghanies near the lower border of the Canadian zone. Connecticut to Illinois; intergrading southeastwardly into the type form *pinetorum* of Leconte, and southwestwardly into *M. p. auricularis* Bailey.

Distribution in Pa. and N. J.—Excessively abundant in light, dry soils of the southern lowlands of both States, nearly every square yard of the arable uplands being pierced by one or more of their tunnels. In waste lands and forests they are also frequent, especially in the sandy pine barrens, but swampy, clayey and rocky lands they dislike. As we rise from these localities into the mountains they become rare, but not wholly absent until we closely approach a Canadian environment.

Habits, etc.—What the common meadow mouse does so largely above ground this strenuous cousin performs beneath the surface. Unfortunately for mankind and fortunately for himself, the pine vole is one of the "hidden works of darkness." Out of sight is out of mind, and, in most cases, out of knowledge. Thus it was that the popular and still persistent error arose of attributing the mysterious underground robberies which yearly spirit away thousands of dollars' worth of seeds, grain, radical and tuberous-rooted vegetables, plant roots, bark of fruit and shade trees, bulbs and buried winter stores belonging to the farmers of southern N. J. and Pa., to moles, shrews, meadow mice, insects, birds, in short, anything which the vexed ingenuity of man could devise as a scape-goat. On the tract where I now reside at Audubon, Camden Co., N. J., there might be found in a narrow belt along the banks of a stream, and in the old unmowed fields comprising about 50 of the whole 125 acres, certain spots where meadow mice, *M. pennsylvanicus*, were common. These would not aggregate 500 specimens, and if the ground had been mowed the number would be diminished more than half. On the remainder practically no meadow mice exist. But the entire soil of this tract of ground, regardless of its condition, whether sod, fallow, orchard or wood, is traversed more or less intricately with the burrows of the pine woods vole. In my garden of 2 acres they so abound that, after irrigation, their net-work of runways, collapsed by the water, are mostly remodeled before it has had time to reach the subsoil, and a spade-full of earth thrown out at random seldom fails to reveal one of their burrows or that of a mole, which both use promiscuously. In this garden not a meadow mouse cares to set foot in summer, yet these cousins of his destroy at least 20 per cent. of the seeds planted and 10 to 15 per cent. of the growing and perfected potatoes, beets, parsnips, celery, cabbages and ruta baga turnips. They destroyed a whole planting of lima beans after growing in some cases to the height of eight inches, many replanted hills being eaten off three times. In the orchard where meadow mice could not exist, these burrowing rascals have completely denuded the entire basal system of roots where they diverge underground from the parent trunk, in this way killing in 2 years apple trees 15 and 20 years old.

It would make easy calculation, on the basis of the experience of any truck gardener in south Jersey (for my own experience is a fair sample, as I have known while working on other farms and from the complaints of my neighbors) to show that this mouse destroys many times more value than all the noxious birds and mammals (the English sparrow excepted) put together. To make the identification of this vole more certain, I will quote from a paper published by me in 1897 in a local weekly. This paper answers a southern correspondent who had confounded the depredations done by this mouse in her garden with those of the short-tailed shrew or mole shrew,

Blarina brevicanda, found in the same burrows: "Undoubtedly the greater part, if not all, of the depredations described must be laid at the door of an animal very dissimilar to the shrew, namely the Pine Vole (*Microtus pinetorum*). I say dissimilar, and yet the short tail, squat form, fossorial fore feet and very small eyes of the pine vole, together with its similar size, might easily deceive a casual observer and make one confound it with the shrew. The pine vole, however, is a rodent and one of the strictest vegetarians of its order. It can be instantly distinguished from any of the *Insectivora*, and from the shrew in particular, by its rounded head, short, blunt snout and the space in the jaws separating the long curved fore teeth from the flat prism-crowned cheek-teeth or molars. In the shrew this vacancy is filled by a ferocious armature of fangs, and the pig-like snout is long and pointed; the eyes also are nearly invisible, while the pine vole has well developed, bead-like eyes. The shrew is of a uniform, dark, glossy lead color, slightly brownish and silvery in certain lights, while the vole is rusty or brown-red above and grayish lead color below. The pine vole belongs to the same genus as the common meadow mouse which haunts our fields and swamps, making the intricate network of surface runs which shows so plainly along the fence rows when snowdrifts melt away. Unlike the meadow vole, the subject of our sketch rarely comes to the surface of the ground, but is almost as subterranean as the mole in its habits. Being less powerful than the mole, it confines its tunnels to looser soils, prefering sandy, fallow ground for its foraging and is especially fond of cultivated fields along the edge of woodland. Should such a field be planted with some tuber-bearing crop the vole is in its element, and the number of burrows which honeycomb the ground is almost incredible. In some sweet potato fields scarce a square foot of the whole field adjoining the woods was left unvisited. The amount of damage which such an army of rodents can perform may be imagined. I have known them to follow along the drills of newly covered seed corn, peas and wax beans so industriously as to require the entire replanting of parts of the field. Their diet however may include the roots and bulbs of some noxious plants. They eat wild garlic roots, often smelling offensively of it. Whether insects are eaten is an interesting question. It does not hesitate to use the burrows of the mole; in fact, moles, shrews, deer mice and pine voles make free use of each other's highways in a most democratic fashion. Mayhap first goes along *Scalops*, the four-footed plowman, industriously heaving the sod and devouring earthworms and larger insects that fall into his furrow; then the mole shrew (*Blarina*) trips through the passage gathering fragments and nosing about for larger game. A pine vole, making a cross-cut, falls into the breach and goes off on an easy exploring expedition for tap-roots, and in due time the deer mouse (*Peromyscus*) tiptoes along gathering crumbs. In these excursions the various tenants of the manor often collide, the great

mole undoubtedly being lord of misrule, the bloodthirsty shrew his licensed retainer, while the mice quarrel over the crumbs. They in turn fall a prey to the arch spoiler *Blarina*, and are by nature's processes reconverted into grass or worms or shrews and the endless cycle is again complete. Well may we exclaim, 'All flesh is grass!' and wonder, while man goes on interfering with the nicely adjusted economies of nature, what difference it makes whether shrews eat vegetables or devour the vegetarian. In either event the grass must suffer!"

On April 19th, 1901, my man plowed over the nest of this species set at a depth of eight inches under the soil in an open field, and captured the parents with 5 young all in the same burrow. Three of the young were twice as large as the other two, the smaller being about an inch long. The nest was globular, of dried grass and weeds. I have taken nursing and gravid females of this species, as with other of the native mice irrespective of season. They probably have 4 to 6 broods yearly, averaging 20 to 30 young per annum.

Mr. Miller (Key to Land Mam. E. N. Amer., 1900, p. 104) says this species "generally occurs in colonies." This remark does not apply to any I have seen. It is more applicable to the meadow mice. He also restricts its northern range to the lower part of the transition zone, but it will be seen in my list that it goes farther, venturing into a mountainous, rocky country quite the anthithesis of that in which it mostly abounds.

Description of species.—To the characters already given for this animal, it should be added that the fur is dense, soft and more mole-like than in the meadow vole. The ears are small and concealed from view. The tail is very short, less than $\frac{1}{3}$ the length of head and body. The northern subspecies, *scalopsoides*, is less rusty than typical *pinetorum* of Georgia, having a grayer or more plumbeous cast.

Specimens examined.—Pa.: Chester Co., Thorndale, 1; Westtown, 1. Clinton Co., above R. Island (1800 ft.?), 4. Delaware Co., Marple, 1; Tinicum, 2. Greene Co., Waynesboro, 2. Monroe Co., Pocono, 1, near Cresco, 1. Pike Co., Porter's Lake, 1. Philadelphia Co., Germantown, 3. Baird records specimens from Carlisle, Cumberland Co. N. J.: Camden Co., Haddonfield, 8; Audubon, 7; Collingswood, 1. Cape May Co., Tuckahoe, 17. Cumberland Co., Bridgeton, 15; Port Norris, 2. Gloucester Co., Bridgeport, 1. Ocean Co., Tuckerton, 2. Warren Co., Delaware Gap, 2.

Genus *Fiber* Cuvier, Lecons d' Anatomie Comparee, 1800, vol. 1, tabl. 1.

Southeastern Muskrat. *Fiber zibethicus* (Linnæus).

1766. [*Castor*] *zibethicus* Linnæus, Systema Naturæ, vol. 1, p. 79.
1817. [*Fiber*] *zibeticus* Cuvier, Règne animal, vol. 1, p. 192.

Type locality.—Eastern Canada.

Faunal distribution.—The muskrat has been recently separated into several races so that the original *zibethicus* is now restricted to eastern N. America from the Rocky Mountains to (not including) Labrador and Newfoundland, and the Atlantic Ocean, and from Georgia and Louisiana to the Arctic zone.

Distribution in Pa. and N. J.—Omnipresent in all situations where there is enough water to float it.

Habits, etc.—This animal is rightly regarded as a great nuisance by those who have the care or ownership of artificial water embankments, because of its extensive and persistent burrowing. Owing to its aquatic habits, wariness and prolific breeding, it defies extermination in the most populous regions. Were it not for the value of its fur and meat, which latter is largely consumed by those who trap it and by the negroes and Italians, it would speedily become a pest in some districts. Some of the Canal Companies of Pa. and N. J. give a bounty on the scalps of muskrats taken on their property besides employing regular trappers to hunt them the year around. In some of the large reclaimed tide marshes of Salem and Cumberland Cos., N. J., the trapping of these animals for fur is so profitable that the larger owners of these dyked lands lease the privilege of trapping upon them for considerable sums of money yearly. An examination of the reports of fur dealers in Pa. and N. J. shows that muskrat furs number five times as many as all other kinds of fur put together, with an aggregate value about double that of all the others. The food of the muskrat is rarely secured at the expense of man, being confined largely to aquatic vegetation of little use in agriculture. I have known one in severe winter weather to travel overland through deep snow to a corn-crib after grain. They damage some grain and vegetables, but the aggregate amount is trifling. They have been accused of eating fish, and have a habit of gathering mussels from the mud and piling them upon logs and rocks to die. The shell thus opens and the contents are devoured by some animal, presumably the rats, though I have never seen them do it. No doubt, minks, coons, foxes, etc., participate in this feast. The muskrat, like the beaver, has two distinct classes of homes, the earth burrow and the house or lodge, in either of which they live, but only rear their young in the former. Along swiftly-flowing streams or lakes without extensive marshy tracts the first kind of home is alone practicable, but in tidewater and open swampy areas which are always submerged and inaccessible except by wading or boat, the rats pile up heaps of grass, reeds, mud and sticks to the height of 2 or 3 feet and 6 in diameter, making an oven-shaped chamber near the top and entering it from below by two or more waterways leading to the distant bed of the stream. This home generally overtops highest tides and flood, and is often so bulky as to fill a cart. The muskrat gives birth to young at all seasons. Godman states that their lodges are only used in winter and new ones are built each

season. This is not always the case. On the brackish tide marshes of Cohansey Creek, Cumberland Co., N. J., I found these rat houses tenanted by other inhabitants of the marsh. The meadow mice, least shrews, and marsh rat (*Oryzomys*) had their galleries in the base and nests in the top of the house, all three living in one house with the muskrat. The eggs of the snapper and terrapin are also found in these houses, and a large crab's remains were often found. The latter may have been brought there, however, to be eaten by the muskrats. In far northern climates, these houses are built over water of sufficient depth to insure against a freezing out. Hearne states that the rats are sometimes frozen in and all perish because of the great size and hardness of the outer dome, which also resists the external attacks of wild animals.

Description of species.—Our Pa. and N. J. muskrat differs from other nominal forms so slightly as to often be indistinguishable from them. It needs no description here, being so different from any other mammal.

Genus *Synaptomys* Baird, Mammals of North America, 1857, p. 558.

Cooper's Lemming. *Synaptomys cooperi* Baird.

1857. *Synaptomys cooperi* Baird, Mammals of N. Amer., p. 558.

Type locality.—Not known. Type presented by Cooper of Hoboken, N. J.; probably captured in N. J. or N. Y. near New York City.

Faunal distribution.—Lower Canadian and transition zones, N. England to Mississippi valley.

Distribution in Pa. and N. J.—East of the Alleghanies in Pa. I have not found this rare animal except in the upper transition zone and lower edge of the Canadian. One was taken in the Ohio valley (upper austral zone) in Beaver Co., in similar situation to those taken by Quick and Butler in Indiana. In N. J. it is, strictly speaking, confined to the transition zone, becoming modified in the cedar swamps of southern N. J. into the race *stonei*.

Habits, description of species, etc.—See next article.

Specimens examined.—Pa.: Beaver Co., Beaver, 1. Cambria Co., Kings, 5; Cresson, 3. Clinton Co., Mt. above Round Isl., 7. Monroe Co., near Cresco, 1. Sullivan Co., Lake Leigh, 1.

Stone's Lemming. *Synaptomys cooperi stonei* (Rhoads).

1893. *Synaptomys stonei* Rhoads, American Naturalist, vol. 27, p. 53.

1897. *Synaptomys cooperi stonei* Rhoads, Proc. Acad. N. Sci., Phila., p. 392; also ibid., 1897, p. 305.

Type locality.—May's Landing, Atlantic County, N. Jersey.

Faunal distribution.—Sphagnum bogs, upper austral zone, eastern border, southern N. J. to Lake Drummond, Va.

Distribution in Pa. and N. J.—Not found in Pa. In N. J. confined closely to sphagnum bogs in the cedar swamp belt.

History, habits, etc.—The air of mystery surrounding the discovery of Cooper's mouse and the long period elapsing after Baird's announcement of it before any specimens were secured east of the Alleghany mountains have made its history peculiar. Another notable thing about it is the fact that it reproduces or rather extends into the austral zone a type of mouse life which had heretofore been considered peculiar to an Arctic climate. Even in the present day with improved methods and knowledge of mouse trapping it is rarely caught, and certainly seems to be very rare compared with its abundant associates, and allies, the meadow and woodland voles of the genera *Microtus* and *Evotomys*. Stone's lemming was first trapped in the deep sphagnum surrounding a small open pool or spring of water near the edge of the big dam at May's Landing. A cedar swamp was near by on one side and the pine barren woods nearly cast a shade over it next to the pond. Not five feet from the same spot Mr. Stone caught his new wood vole, *Evotomys*, while we were here on a previous visit. Specimens of both novelties were taken later in the same place, and, as will be noted, several others have been secured in other parts of N. J. Of the habits of this lemming we are quite ignorant from observation of the living animal. The places where I have found true *cooperi* in the east have never been in woodland, but generally swampy mountain clearings near woods among dense grass and weeds, and appearing to use the same paths as the common meadow mouse. By setting traps in these you generally have to thin out the meadow mice before a *Synaptomys* will have a chance to be caught, ratio of the two being as 1 to 30 in favor of *Microtus*. Undoubtedly swamp grasses and succulent weeds such as we know to form the main food of *Microtus* are the lemming's chief diet also. The same remarks apply to Stone's lemming, only it keeps more closely to the sphagnum beds where there is no need for it to expose itself to the sun and heat of a warmer clime. In these places it acts as a sort of go-between for *Microtus* and *Evotomys*, yet it is more essentially Microtine in its associations here also, and frequent are the trapper's disappointments to find so many lemming-like captures turn out to be voles when their long tails come to view. I have never found the nest of *Synaptomys*, but Quick and Butler (Amer. Nat., 1885, p. 114) describe it as "always under cover, generally in a hollow log or stump and composed of fine grass. It is not so securely built as the nests of some of the other species of this family." Another peculiar circumstance in regard to Cooper's lemming is the difference of its chosen habitat in the Ohio Valley from what we find east of the Alleghanies. I took a specimen in spring, 1898, on a high, dry, rocky hillside pasture among grass and stump land about a mile from the town of Beaver, Pa. A large colony of *M. pennsylvanicus* lived on this hillside, but this was

the only lemming captured among a large number of voles. Quick and Butler (*supra citat.*) found them solely in such places in Indiana, saying: "This mouse is found on hillsides in high, dry, blue grass pastures where flat stones are irregularly scattered over the surface; it especially prefers what are known as 'woods pastures' containing little or no undergrowth." He continues: "Cooper's mouse has been found breeding from February to December. It has never been known by the authors to bring forth more than four young at a time. In all suckling females brought to our attention the mammæ have apparently been but four." A female taken by me Oct. 7, 1898, in Clinton Co., Pa., contained five embryos.

Quick and Butler say that the food of Cooper's mouse is chiefly stems of blue grass and white clover, and the tuberous roots of "wild artichoke" (Helianthus).

Description of species.—The *cooperi* form of lemming looks like a stump-tailed, thick-set and undersized meadow mouse, *Microtus pennsylvanicus*, the color being very similar but the fur is softer and fuller. The color above is grizzled gray and yellowish-brown, thickly sprinkled with black, the belly a frosted or silvery lead color. From an examination of specimens from Indiana and Ohio I am inclined to class these as intergrades between *cooperi* and *gossi*. The peculiar habits of Ohio Valley specimens strengthen this view. The Beaver Co. specimen is nearer *cooperi* of course. In subspecies *stonei* the size and body measurements are greater than in *cooperi;* the relative size of skull and teeth is much larger and the colors darker, especially on the under side, with a strong wash of clay color over the abdomen and breast not seen in *cooperi*. In these differences there is a significant parallel to those distinguishing *Evotomys gapperi* and *E. g. rhoadsi* of the same regions. Naturalists have recognized them in *Evotomys* but are slow to accord the same to the *Synaptomys* under consideration. Dr. Merriam, who later described a *Synaptomys* from Dismal Swamp, which differs from *cooperi* in the same particulars as those given for *stonei*, ignores *stonei*, making it a synonym of *cooperi*. He makes his *helaletes* a full species, and a form he named *gossi* from Kansas as a subspecies of his Dismal Swamp animal! See Merriam, Proc. Biol. Soc., Washn., 1896, p. 58, etc. For a resume of the relations of these forms, see my article in the Proc. Acad. Nat. Sci., Phila., 1897, pp. 305, 307.

Measurements.—(*cooperi*) total length, 118 mm. (4⅝ in.); tail vertebræ, 16 (⅝); hind foot, 19½ (¾); skull, greatest length, 26.5 ($1\frac{1}{16}$); greatest width, 16 (⅝). (*stonei*), in same order, 125 ($4\frac{15}{16}$); 20 ($\frac{13}{16}$); 20 ($\frac{13}{16}$); skull, 27.8 ($1\frac{1}{16}$); 17.7 ($\frac{11}{16}$).

Specimens examined.—Atlantic Co., May's Landing, 3; Cape May Co., Tuckahoe, 1; Cumberland Co., Port Norris, 3.

Family DIPODIDÆ; Jerboas.

Genus *Zapus* Coues, Bulletin U. S. Geolog. Surv. of Territories, 2d series, vol. 1, p. 253.

Hudson Bay Zapus, or **Meadow Jumping Mouse.** *Zapus hudsonius* (Zimmermann).

1780. *Dipus hudsonius* Zimmermann, Geogr. Geschichte d. Menschen, Thiere, vol. 2, p. 358.

1875. *Zapus hudsonius* Coues, Bulletin U. S. Geolog. Survey, Territories, 2d series, vol. 1, p. 253.

Type locality.—Hudson Bay.

Faunal distribution.—Hudsonian, Canadian and Transition zones; Hudson Bay and Gulf of St. Lawrence to northern N. Jersey, west to northern Rocky Mts. and Great Plains, south in the Alleghanies to North Carolina.

Distribution in Pa. and N. J.—Abundant, locally, in open meadows, swamps and in fields contiguous to water; rarely entering woodland. Restricted in its typical form to the parts of Pa. and N. J. included in the transition and Canadian faunæ; giving place in the upper austral zone to subspecies *americanus*.

Records in Pa. and N. J.—In the limits of distribution of typical *hudsonius* it is so universally, and in many cases, abundantly represented where swampy meadows abound, that it is superfluous to record localities where it has come under observation.

Habits, etc.—Many people who know this elegant creature from chance observation in their outdoor rambles, and easily distinguish it from all other of our so-called "wild mice" by its enormous leaps, long tail and kangaroo-like hind legs and feet, have no acquaintance with its habits. It does not do much leaping in ordinary life, but rather as a quick way of escaping the thousand terrestrial ills to which its humble, every-day life is subject. It is of a most timid nature and ill-fitted to combat tooth and nail with the doughty meadow mice and shrews which infest its feeding grounds. Through the cover of grass and weeds which overarch the hidden mouseways the leaping *Zapus* finds a safe aerial passage from troubles earthy, sentimental and otherwise. In all his jumping that lever-like tail is only a rudder and balancing rod ever held at a gentle upward curve, tip-uppermost, from the ground, and when flying through the air acting as a trailer and balancer to bring him gracefully to his feet again in good shape for another leap. I can see no difference between this leaping of the long-tailed mouse and that of the tailless spring-frog which haunts the same marshes, except that the frog does not rise so high in the air. Their reasons for jumping are mostly identical. When

they find their danger is from above the grass they soon learn to skulk rather than leap. I have been unable to trap this rodent after the first few killing frosts, these being the signal for retiring into some snugly prepared corner where they may curl into a spherical shape within a spherical nest of leaves and grasses and sleep until frost departs again. This hiding place generally seems to be placed far enough beneath ground to escape freezing in this latitude. I know of no food provision being made for winter as with the chipmunk. In fact they would be helpless to use it, as a freezing temperature soon begins to stupefy them. Abbott states they appear to store up chinkapins for future use in November. They can be thawed out and frozen again artificially several times before they succumb to this inhuman treatment. When going into winter quarters they are excessively fat, as I can testify from experience in removing this tenacious yellow blanket from the skins of them. This fat is their fuel. By spring it is nearly gone. Their natural food I have not been able to certainly identify. It is stated by some to be buds, seeds, nuts and grasses. They eat corn and oatmeal bait from my trap. It is likely they may devour a good many insects, for capturing which their agility would eminently fit them. Inquiry along these lines might show this animal to be one of the most useful (as it certainly is one of the least destructive) of our small rodents. Abbott says they eat but little grain and are too scarce to do any harm even if they had that failing.

Description of species.—Species of this genus may be known from all other American mice by their having a body the size of a house mouse with long, slender, almost naked tail, which is 1½ times as long as head and body. The hind foot, in its great relative size to length of body, is also distinctive. The head is very small and the slender front teeth have a distinct groove running down the face of each, in this respect resembling the little harvest mouse (*Reithrodontomys*), a species we do not find in Pa. and N. J. *Zapus hudsonius* is to be distinguished from *Z. h. americanus*, the next form to be considered, by its larger size and the better defined, dark dorsal stripe in contrast with the color of sides. In *hudsonius* the upper colors are yellowish-brown, with sides light grayish-buff, lightly sprinkled with black. In *americanus* the back is dusky-brown, tinged with reddish-buff, sides reddish-buff. Both are snowy white beneath. Both forms of these meadow or open-ground *Zapus* may be known externally from the woodland, *Napæozapus*, by grayer color, smaller size and the lack of a white tip or terminal part of the tail.

Measurements.—(*hudsonius*) total length, 220 mm. (8½ in.); tail vertebræ, 130 (5½); hind foot, 31 ($1\frac{3}{16}$.) (*americanus*) 190 (7½); 115 (4½); 18 (1½).

Barton's Zapus, or **Meadow Jumping Mouse.** *Zapus hudsonius americanus* (Barton).

1799. *Meriones americanus* Barton, Transactions American Philosophical Society, Phila., vol. 4, p. 115.

1899. *Zapus hudsonius americanus* Batchelder, Bulletin New England Zoölog. Club, vol. 1, p. 6.

Type locality.—Philadelphia, Pa.

Faunal distribution.—Upper austral zone; Connecticut to eastern North Carolina; coast plains. Also in southwestern Pa.; probably west along Ohio Valley lowlands. Western range not mentioned by Preble in N. Amer. Fauna, No. 15.

Distribution in Pa. and N. J.—This lowland race is found in southeastern and southwestern Pa., the two sections occupied by it being separated faunally by the Alleghany mountains, in which only the northern type is found. Preble, the monographer of this group, records no specimens from west of the Alleghanies. I have examined specimens from the upper austral lowlands of the southwestern corner of Pa. and would class them with *americanus*. In N. J. this animal is sparsely found in the southern half of the state. A specimen having been secured from Beach Haven, a coastal sand-island beach, indicates that they may be found anywhere in this great territory. That they are exceedingly rare in such situations or in other parts of the pine-barren region, my own researches go to confirm the popular verdict.

Habits, etc.—I extract from Mr. Preble's monograph of the genus *Zapus* the following facts, which add to the information already given under *Zapus hudsonius*. The average length of the longest leaps is about 8 feet. They breed from May until September, both above and beneath the ground. They build summer-house nests on the ground in the thick grass, globular with a side entrance and composed of leaves of grass. A pair use this home. Hibernation is not always complete or uninterrupted, Dr. Merriam having seen them abroad in northern New York during the unusually mild winter of 1881–'82. Mr. G. S. Miller, Jr., narrates how a young jumping mouse, whose long tail had been cut off by the knife of a mowing machine, thereby wholly lost control of its leaping powers. While stimulated by his approach to make astonishingly long and high leaps, it would turn somersaults in the air, often landing in a reversed position from the starting one and thus returning at the next leap toward the object of its fears. That this misfortune would not always prove fatal, I have proof from an old individual, whose stump tail was about two inches long, entering my traps. It was otherwise in good condition, though the end of the tail showed it had been a long while in this plight.

Specimens examined (only extralimital records noted).—Pa., Allegheny Co., Wilkinsburg, 1; Beaver Co., Beaver, 1; Greene Co., Waynesburg (recorded by Jacobs); Washington Co., Washington, 2; Westmoreland Co., Laughlintown (intermediate), 1. Numerous specimens from southeastern Pa. N. J., Burlington Co., east of Medford, 2; Mt. Holly, 1; Camden Co., extremely

rare, even near Camden; Gloucester Co., near Woodbury (seen by Johnson); Ocean Co., Beach Haven, 1.

Miller's Woodland Jumping Mouse. *Zapus insignis* Miller.

1891. *Zapus insignis* Miller, American Naturalist, vol. 25, p. 742.

Type locality.—Restigouche River, New Brunswick, Canada.

Faunal distribution.—Miller states that this mouse "is an inhabitant of the Canadian zone, reaching the transition zone in 'boreal islands' only." I have found it in both Pa. and N. J. in parts of the upper transition zone where no "boreal islands" exist. It is found as far west as Lake Superior, south to western Maryland, north to Labrador.

Distribution in Pa. and N. J.—So far this handsome dweller of the dark forests has been recorded from a few isolated spots in the Alleghanian regions of Pa. and with certainty in one locality in N. J. In some favored localities it is numerous, in others, apparently similar, they are not found. Owing to its choice of the most densely-wooded evergreen tracts, its range is, and long has been, rapidly contracting.

Records in Pa.—Cambria Co., one collected near Cresson.—Rhoads. *Clinton Co.*, stated to have been seen among the trout streams by Nelson and Peirce. *Elk Co.*, a specimen from Howard Sta. in collection of Pierce of Renovo.—Rhoads. *Monroe Co.*, taken by W. A. Shryock near Pocono in 1893, the first record for Pa. One killed by Yaggie crossing Bushkill Creek in 1894.—Rhoads. *Potter Co.*, one was found dead near Cherry Spring, June 23, 1898.—Todd. *Somerset Co.*, a specimen in my collection taken near New Lexington by Dr. H. D. Moore.—Rhoads. *Sullivan Co.*, two taken by Rhoads at Eaglesmere in August, 1896. Dr. Merriam states in a letter to me that this species has been taken at Finzel, Md., ¼ mile from *Somerset Co.* line.—Rhoads.

Records in N. J.—Morris Co.—"I secured four beautiful specimens of this *Zapus* in woodland along a small rocky stream connecting a rhododendron swamp with Lake Hopatcong near Nolan's Point."—Rhoads, Proc. Acad. Nat. Sci., Phila., 1897, p. 29.

Passaic Co.—"At Greenwood Lake a dormant jumping-mouse, from the description given me by the finder, being evidently of this species, was dug out of a gravel bank during my stay (Oct. 24th to 30th, 1896). I visited the spot, and from its situation in deep woodland near a brook, I am morally sure it was *Z. insignis*. The narrator of the incident stated that he knew the meadow species very well, but that this one was 'much redder.'"—Rhoads, *ibid.*

Habits, etc.—I have never seen one of these animals alive, being acquainted with them only by post-mortem examinations, and by their foot-prints along

the sands margins of streams where they had been caught. From their striking appearance when found dead in a trap, I do not hesitate to place them in the highest rank among all our east American mammals for exquisite coloration, grace of form and elegance of manners. No doubt their habits in some respects may be predicted from what we know of the commoner meadow jumping-mice, whose hunting grounds in the far north to some extent overlap those of their more refined and aristocratic cousins. Nevertheless the swamp-mud and tangled-grass dweller has little in common with one who seems to choose the night season only for his rambles along the clean shingle and sand of the little trout brooks, creeping and leaping about from boulder to boulder and diving among the ferns and deep beds of moss at each whisper of alarm. In the daytime I have never seen them move about nor caught any in my traps, and conclude they are more nocturnal than *Z. hudsonius*. "*Napæozapus*" seems never to be found out of close reach of a stream. If you fail to catch him there, it is useless to look in other parts of the forests for him. As he is attracted by raisins and oatmeal, there is little doubt of the rather omnivorous character of his diet. Having been unable to trap this animal in any given season as late as *Z. hudsonius* in the neighboring marshes, I conclude that it begins to hibernate sooner than that animal. The peculiar, and in most cases conspicuous, white tip to the tail of the woodland jumping-mouse cannot but excite our curiosity, especially when it is remembered that *Z. hudsonius* does not show it. Owing to its variable amount, ¼ of an inch to 1¼ inches, it seems to show a condition of change, not improbably toward a future atrophy of the terminal vertebræ and shortening of a member which some change in environment has shown to be uselessly or dangerously long.

Description of species.—There is only one American species of this subgenus known, divided into three races, typical *insignis* of the Canadian zone, *roanensis* of the Great Smoky Mts., and *abietorum* of the Hudsonian zone. None of these are known to reach farther west than Lake Superior. They are characteristic of the east Canadian and Alleghanian territories. Any *Napæozapus* can be distinguished from all other American jumping mice by larger size, longer ears, fulvous or buff yellow coloration, especially on sides of head, fore neck, and on ears, with much less admixture of the black hairs seen in other species. It is never suffused with clay or fulvous on white underparts as in *Zapus*, and lacks the upper premolar, a small peg-like functionless tooth characteristic of *Zapus*, the absence of which in *Napæozapus* is the only reason for its subgeneric separation from our other jumping mice. I am unable to reconcile the elevation of this subgenus to full generic rank with the fundamental rules of classification.

Family ERETHIZONTIDÆ; Stifftailed American Porcupines.

Genus *Erethizon* F. Cuvier, Memoir Museum d'Histoire Naturelles, Paris, 1822, Vol. 9, p. 426.

Canada Porcupine; "Hedgehog." *Erethizon dorsatum* (Linnæus).

1758. [*Hystrix*] *dorsata* Linnæus, Systema Naturæ, vol. 1, p. 57.

1852. *E*[*rethizon*] *dorsatum* F. Cuvier, Memoir Museum d'Histoire Naturelles, Paris, vol. 9, p. 426.

Type locality.—Eastern Canada.

Faunal distribution.—Canadian, Lower Hudsonian and upper transition zones; Atlantic Ocean to the Great Plains.

Distribution in Pa. and N. J.—Once abundant in all the mountainous and well-forested areas of the Canadian and upper transition zones in Pa. Also once found sparingly in parts of the mountains of northern N. J., but a long while exterminated in that State.

Records in Pa.—The following have been sent in answer to inquiries as to distribution and present status of this species:

Armstrong Co.—"I have heard reports of the occurrence of this species in the Buffalo Creek region of Armstrong Co."—Todd, 1902.

Bradford Co.—Reported by Stevens.

Bucks Co.—Subfossil remains found in Durham Cave in 1893 near Riegelsville, identified by Prof. E. D. Cope.—Mercer.

Butler Co.—"I have heard reports of the occurrence of this species in the Buffalo Creek Region."—Todd, 1902.

Cambria Co.—"Rather scarce, but some found over the mountains in 1900."—Shields. Plentiful in the vicinity of Lloydsville in winter of 1897–1898."—Todd.

Center Co.—Present in wilder parts of the Co.—Fernald, 1900.

Clearfield Co.—"I saw a dead specimen in northern part of Co., June, 1899."—Todd. "An exceptionally fine one received from Mr. E. K. Morse, killed near Penfield, Dec. 8, 1900."—Todd.

Clinton Co.—Several specimens have been sent me from time to time by Seth Nelson, who reports them numerous. In my own experience I found this to be the case in the same region in 1898. They seemed to prefer the tops of the mountains, but sometimes came down to the banks of the Sinnemahoning.—Rhoads. Plenty around Mill Hall in 1879.—Pfoutz.

Columbia Co.—"A stray one seen now and then; plenty on North Mountain."—Buckalew, 1900.

Crawford Co.—Rapidly disappearing; only to be found in northeastern corner of Co.—Kirkpatrick.

Elk Co.—Decreasing.—Luhr, 1900. No decrease in Co. Plentiful in the mountains.—Clay, 1900.

Erie Co.—Not rare in the mountainous parts of Co., but do not reach the lake near Presque Isle.—Bacon, 1900.

Forest Co.—Abundant in hemlock woods.—Zendle, 1900. Increasing in this Co.—Haslet, 1900. As the Co. is cleared off they decrease.—Irwin, 1900. Plenty in this Co. and a great nuisance, gnawing oil derricks.—Dorworth, 1900.

Franklin Co.—An unknown animal in this region (South Mountain).—Strealy, 1896. One was shot by George Wrights in the woods near Upper Strasburg, Sept. 18, 1897.—Strealy.

Fulton Co.—Will Montgomery shot one about 1878 on the west side of Sideling Hill near Locust Grove.—J. Cope.

Huntingdon Co.—Not known near Mt. Union.—Ingersoll, 1896. A few yet found near Entriken in 1898.—Todd, fide I. Donaldson.

Jefferson Co.—"I once handled a specimen from near Reynoldsville."—Nease, 1898.

Juniata Co.—A mountaineer named Wildmann told Mr. Ingersoll that he had heard of one being killed in northern Juniata Co., on the Black Log Mountain.—Rhoads, Proc. Acad. N. Sci., Phila., 1897, p. 210.

Lackawanna Co.—"I have received 3 specimens from the Co. to be mounted in the last 10 years."—Friant, 1898.

Luzerne Co.—Numerous.—Campbell, 1900.

Lycoming Co.—"Generally distributed in the mountains of this Co.; not decreasing."—Parker, 1900.

McKean Co.—Plenty, and a nuisance; eating oil derricks.—Dorworth, 1900. Decreasing.—Dickeson, 1900.

Monroe and Pike Cos.—Their "presence on the Pocono plateau has always been rather precarious, and with the vanishing forest areas, it has become so rare that it is believed by many hunters to be exterminated. The most active of these gentlemen have not seen any 'for several years.'"—Rhoads, Proc. Acad. N. Sci., Phila., 1894, p. 393. A specimen shot several years ago in Pike Co. is in the collection of E. W. Campbell, of Pittston.—Rhoads, 1902. Remains of this animal in the superficial layer of Hartman's Cave, Monroe Co. are referred to by Leidy (Rep. Pa. Geol. Surv., 1887) as those of existing porcupine.—Rhoads.

Potter Co.—"Decreasing. Plenty as late as 1880. Few left in 1900."—Austin. Plenty in 1900.—Dorworth.

Somerset Co.—"Preble, my assistant in the Biological Survey, was told [in 1893] that the porcupine was formerly common at Crumb."—Merriam. Stated by Dr. H. D. Moore, of New Lexington, to be nearly extinct in his vicinity. He sent me some of the quills from one freshly killed near there Nov. 5, 1899. This specimen was sent to the Carnegie Museum, Pittsburgh.

Sullivan Co.—I have seen them numerous around Eaglesmere.—Rhoads. Common at Eaglesmere.—Bennett, 1900. Becoming scarce.—Rothrock, 1900. "In all timbered tracts, living chiefly on hemlock brush; knew one to stay in one tree two months without descending. Becoming scarcer."—Behr, 1900.

Tioga Co.—"In hemlock forests and rocky ledges, still plentiful."—Cleveland, 1900. Plenty.—Babcock, 1900.

Union Co.—"Probably extinct in this Co. The last one known to me was killed [or seen?] in 1879."—Chambers.

Venango Co.—Not common in Venango Co. One was killed near Oil City, Oct. 7, 1899.—Dorworth.

Warren Co.—Plenty; disturbing oil derricks where saturated with salt from the wells.—Dorworth, 1900.

Washington Co.—Two were said to have been found near the borough of Washington in 1897.—Nease.

Wayne Co.—Decreasing.—Goodnough, 1900. None found in the vicinity of Maplewood.—Stevens, 1900. "Still found in Wayne Co. Two killed near Dyberry this year [1900]."—Day. Scarce, some left where there is timber.—Teeple, 1900. Frequently seen but decreasing.—Kellew, 1900.

Wyoming Co.—Plentiful. On the increase.—Robinson, 1900.

Records in N. J.—Warren Co.—I have understood from Mr. Strickland, of Blairstown, that the porcupine was formerly found in the higher mountains of this county near the Delaware. As it is a fearless swimmer it may cross the river from Pike County occasionally.—Rhoads, 1902.

Habits, etc.—As the habits of this clumsiest, most stupid, ungainly and untouchable of rodents are known to so few people, I will outline them briefly. They are nowhere "in their element." In water they can just manage to paddle and scull along, being too fat to sink. On land they crawl like a huge tortoise both in pace and gait. When pursued on land they seek preferably the nearest hole that will at least cover the head, wedging themselves tightly therein, leaving the huge bristling back and the ponderous tail for the enemy to fool with. Sometimes they take to a tree, ascending to the summit, but they are slow climbers. The tail is used as a flail to parry attack. The quills are not detached except by contact, anchoring themselves by the finely barbed points, and thus become detached from their loose hold on the porcupine's skin. They work their way into skin and muscles quickly and automatically, and are found in all parts of the anatomy of wild animals which sometimes eat porcupines when driven by hunger. Porcupines are said to be arboreal. They do ascend and descend trees to get bark and twigs for food. In doing so they again display their innate awkwardness, the huge tail lurching from side to side as they shin slowly up, threatening at every step to throw the animal to the ground, but their strength is enormous, and sheer might of

hugging and clawing, tooth and nail, gets him his breakfast. Unless they can reach the top of a large or tall tree before being seen, they will hastily descend a smaller tree when discovered and bolt for their rocky dens in the most ludicrous and stupid fashion. They are more at home among rock piles and caverns than anywhere else and once jammed head foremost in such retreats neither man nor beast can dislodge them. In these places they bring forth the young. They spend a part of the winter here in a semi-hibernation. At the same time they can remain indefinitely during the same season in the lofty forks of a hemlock or pine. They are to some extent destructive of timber by girdling the bark. Owing to their love of salt they visit camps and cabins and eat away the woodwork and utensils which have become saturated with saline matter, causing great annoyance by the nightly noise and destruction. Oil derricks, etc., where saturated from salt springs are destroyed also. They eat the flesh, bones and horns of dead animals in the woods with great avidity. Sometimes they ascend an oak or other tree, and as if from mere wantonness strew the ground with cartloads of brush, clipped from the branches as with a knife. My friend Seth Nelson explained to me that owing to the back spines they were unable to copulate in the usual manner of quadrupeds, but the sexes ascend a tree and hang facing each other on opposite sides of a small limb, thus embracing without damage, the underside of the body being devoid of spines. Herrick, in "Mammals of Minnesota," says he found one eating the tender shoots of *Sagittaria* or narrow-leaved pond lily, its stomach being crammed with these. In eating these it made a remarkably loud and clattering noise with its teeth. It appears that they eat a large variety of vegetable food, but that the staple diet is from pine and hemlock timber, the inner bark being especially relished. They have few young at birth, generally two, and the relative size of the fœtus just before birth is said to be extraordinarily great, absolutely greater than that of the black bear. When attacked by blows or mortally wounded, the moaning, groaning and sighing sounds which they make are so human-like and pitiful that no person thus treating them out of mere curiosity or wantonness, would be likely to repeat the offense on these grounds alone. They often form an emergency meat diet for the lumberman and camper, their flesh, as I can testify, being palatable and nourishing, though tough and dark in an old specimen. It has a peculiar odor before cooking which would repel faint stomachs. Mr. S. Nelson tells me they smell in their dens like a negro; have 2 to 4 young at a birth; eat fir, pine, aspen and chestnut bark and twigs, also moss; do not hibernate; flesh takes on quality of food, and is very good when they are eating chestnuts.

Description of species.—As it is impossible to confound this with any other east American animal, I need merely state that it is brownish and sooty black, showing lighter where the greater quills of back and hind head grow thickest.

The hair is wiry, sparse and extends in places 3 or 4 inches beyond the quill tips. The length of a full grown one is sometimes 3 feet, 1 foot of which is tail. The tail is a flattened, elongate, blunt triangle; the whole build of the animal resembling that of an awkward, hunchbacked, hypochodriac beaver. Their maximum weight when fat is very great, reaching upward of 35 or 40 pounds.

Family LEPORIDÆ; Hares, Rabbits.

Genus *Lepus* Linnaeus, Systema Naturæ, 1758, vol. 1, p. 57.

Alleghenian Varying Hare; White Rabbit. *Lepus americanus virgininianus* (Harlan).

1825. *Lepus virginianus* Harlan, Fauna Americana, p. 196.

1877. [*Lepus americanus*] *virginianus* Allen, Monograph N. American Rodentia, p. 307.

Type locality.—Blue Mountains, northeast of Harrisburg, Pa.

Faunal distribution.—Canadian and upper transition zones, New Brunswick to Minnesota, south in Alleghanies to North Carolina.

Distribution in Pa. and N. J.—Once an abundant dweller of the wooded parts of the Canadian and transition zones of both states. Now almost exterminated in N. J. and found only in numerous isolated and restricted situations in the Allegheny and Blue ridge mountain systems, this decimated condition being due to deforesting and burning rather than to direct destruction by man or wild animals.

Records in Pa.—Bearing in mind the abundance of this species only 30 years ago, the following reports from its former haunts will give some idea of present conditions:

Blair Co.—A specimen recently taken in this Co. is in Museum of Acad. Nat. Sci., Phila. They were reported to Ingersoll as living, in 1896, 10 or 12 miles from Tyrone.—Rhoads.

Cambria Co.—"Old hunters of southern Cambria Co. formerly knew of them, but they had been killed off several years ago."—Ingersoll, 1896. "A few remain, especially around Shade Creek. They were formerly distributed all over this county."—Shields, 1901.

Cameron Co.—"Numerous, but decreasing as the woods are cut off."—Larrabee, 1896.

Centre Co.—Found along the mountain tops—Fernald, 1900.

Clearfield Co.—Two specimens were sent to Acad. Nat. Sci., Phila., from Bell's Landing (in 1890?).—Rhoads.

Clinton Co.—I saw one in July, 1895, near Round Island.—Nelson. "Some

left near Mlll Hall, but not many."—Pfoutz, 1901. Once abundant on the mountains near Round Island but so decreased that Nelson, after two years' endeavor, was unable to get me any specimens except two or three old skulls. I made special search for it in this region without finding a track in 1898. The common rabbit, once a rare or unknown species in these mountains, is now numerous there.—Rhoads, 1902.

Columbia Co.—"Once plenty, now superseded by the gray rabbit in Columbia Co., except in the North Mountain."—Buckalew, 1900.

Crawford Co.—"Formerly in Pymatuning and Conneaut marshes and in the Cussewago and French Creek valleys, but none killed for several years."—Kirkpatrick, 1900.

Elk Co.—Quite plentiful.—Clay, 1900.

Erie Co.—Once common; last known to be taken in the Co. was 9 or 10 years ago.—Bacon, 1900.

Forest Co.—I killed one, winter 1898, near Newtown Mills.—Zendle. "Range with the deer; poor eating."—Haslet. Rare in this Co.—Irwin, 1900.

Franklin Co.—Mr. Strealy, of Chambersburg, member of a hunting club, whose acquaintance with the animals of the South Mountain (Franklin, Adams and Cumberland Cos.) is thorough, says there are none of this species found there nor has he known of them there in the past.—Rhoads, 1902.

Huntingdon Co.—Long extinct near Entriken.—Todd, 1901. Found west of Mt. Union.—Ingersoll, 1896.

Juniata Co.—Not known of around Tuscarora.—Ingersoll, 1896.

Lackawanna Co.—Several taken in the Co. near Scranton have been preserved for hunters by G. P. Friant. One is in the Wagner Museum, Phila.—Rhoads. I shot one in Lackawanna Co. near Clifton.—Campbell, 1900. Plentiful in Lack. Co., called "Hare."—Stevens, 1900.

Luzerne Co.—Numerous.—Campbell, 1900. Rare.—Stocker, 1900.

Lycoming Co.—Found occasionally.—Rothrock, 1900. Found on North Mountain.—Buckalew, 1900.

McKean Co.—Several taken near Warren, winter 1898–'99.—Todd. Found throughout Allegheny and Susquehanna watershed.—Dickeson, 1900.

Monroe and Pike Cos.—"Not uncommon in the higher mountain swamps."—Rhoads, Proc. A. N. Sci., Phila., 1894, p. 393. Some left in swamps near Long Pond.—Campbell, 1902. "Some found in thinly-settled parts of northern townships of Monroe Co."—Bisbing, 1900.

Potter Co.—"The 'cottontails' have overrun the country in Potter Co. once inhabited solely by the northern hare."—Austin, 1900, Yet numerous in our Co.—Austin, 1900.

Somerset Co.—"Preble was told in 1893 that the white rabbit was formerly common near Crumb." "Preble was told of the occurrence of *Lepus virgin-*

ianus at Finzel, Md., only ½ a mile from the Pa. line."—Merriam. "Not plentiful at Elk Lick, but there are some."—Mier, 1902.

Sullivan Co.—"Found all over wooded districts, but diminish as big timber is removed. Rhododendron swamps are their haunts in winter."—Behr, 1901. Abundant about Eaglesmere.—Bennett, 1896. "The 'Jack rabbit' is found occasionally between Highland Lake and Eaglesmere and in other parts of the Bald Eagle mountain."—Parker, 1900.

Tioga Co.—"Driven by gray rabbit from clearings into deep swamps."—Cleveland, 1900. Plentiful; thousands in this locality (Blossburg).—Babcock, 1900.

Union Co.—"Seen a few years ago in the mountains. Some probably remain in Union Co."—Chambers, 1900.

Venango Co.—"Not found. Have endeavored to stock our woods with them without success."—Dorworth, 1900.

Wayne Co.—Numerous.—Stocker, 1900. Fast decreasing.—Goodnough, 1900. Quite a number to be found in swamps.—Stevens, 1900. "Decreasing; 3 or 4 shot in Nov., 1899, at White's Valley, only half white."—Day. Some left.—Teeple, 1900. A few killed in the swamps every winter.—Kellew, 1900.

Wyoming Co.—Found all over wooded districts.—Behr, 1901. Quite plenty on the mountains in some places.—Robinson, 1900.

Records in N. J.—Passaic Co.—Exterminated in the vicinity of Greenwood Lake mountains about 1890. Larkin Hazen shot one in the mountain just north of the state line, Orange Co., N. York, in 1891.—Rhoads.

Sussex Co.—They used to frequent the tamarack swamps near Culver's Lake and Long Pond, and were thought by hunters to still exist there in 1896. I was unable to find any in these swamps, however.—Rhoads.

Warren Co.—Mr. Strickland, of Blairstown, told me that a few still existed around the high mountain swamps and lakes of the Kittatinny Range.—Rhoads, 1902.

Habits, etc.—My knowledge of the habits of this hare is derived solely from accounts given me by hunters. It does not differ very greatly from the cottontail in habits, but prefers secluded swamps and shaded, wooded retreats to those more open ones frequented by the smaller species. The apparent driving out of this large species by the latter is to my mind solely due to deforestation, bringing about a climate fatal to its existence over vast tracts once congenial. I doubt greatly if the small rabbit in any way persecutes its rival, but it merely follows the "opening up of the country" because that process enables it to live where formerly the virgin forest conditions excluded it.

The food of this hare being chiefly of trees and bushes, is of such a nature at certain seasons as to make its flesh greatly inferior to that of the cotton-

tail, being hard, dry and juiceless. Bachman says they never retreat, when pursued, to holes or burrows. When snow is deep its large feet support it so that it can escape dogs as if provided with snowshoes, hence one of its popular names. It does not forage in open fields or country, hence is not destructive to crops, however common. They have 2 litters of 4 to 6 each yearly, born in May and July or August. They prefer coniferous to deciduous woods.

Description of species.—This animal, like the weasel, turns more or less white in winter. In the transition zone it rarely becomes much white, some individuals changing but slightly from their summer color. The dispute regarding the method by which this color change is accomplished has been often settled, but by no one more conclusively than by Dr. J. A. Allen, in the Bulletin of the American Museum of Natural History, in which he proves that the summer and winter coats, whatever their colors may be, are acquired, and the color also, by the molt which regularly occurs in spring and fall. The animal has no power to change the color after the new hair begins to grow, but the disposition and physical condition of the animal, the climate in which it lives and other mysterious effects of its environment, determine the amount of white which shall be acquired in any given place and at any season. Undoubtedly this turning white in winter is primarily intended as a protective measure for the existence of the species during the season of snows, great cold and increased activity of beasts of prey.

The Alleghanian hare is larger, and longer by two inches, than the cottontail hare of the same regions. Its most distinguishing features are color and the great size of the hind foot. In winter the two are readily separated; in summer the larger species is bright rusty brown, with ears dusky at the tip and bordered with whitish, while the cottontail is wood-brown or yellowish-brown mixed with black hairs above, and has plain brownish ears.

Measurements.—Total length, 485 mm. (19); tail, 50 (12); hind foot, 140 (5½).

Specimens examined.—From following Pa. counties: Blair Co., 1. Clinton Co., 6. Clearfield Co., 2. Lackawanna Co., 2. Luzerne Co., 1. Potter Co., 2. Sullivan Co., 4. Tioga Co., 1.

Alleghenian Cottontail or Rabbit. *Lepus floridanus transitionalis* (Bangs).

1895. *Lepus sylvaticus transitionalis* Bangs, Proceedings Boston Society Natural History, vol. 26, p. 405.

1899. *Lepus floridanus transitionalis* Allen, Bulletin American Museum Natural History, vol. 12, p. 13.

Type locality.—Liberty Hill, New London Co., Connecticut.

Faunal distribution.—Transition and deforested Canadian zones; southern New England to and including watershed of Allegheny and Susquehanna Rivers, south along the Alleghenies to (and beyond) Maryland, intergrading northward and westward into subspecies *mearnsi*, and southward into *mallurus*, the races next considered.

Distribution in Pa. and N. J.—Cotemporary with the transition zone in these states (see map). Not found in northwestern Pa., where it is replaced by the prairie race, *L. f. mearnsi*, next considered.

Records, habits, description of species, etc.—See beyond under *L. f. mallurus* or Southeastern Cottontail.

Eastern Prairie Cottontail or Rabbit. *Lepus floridanus mearnsi* (Allen).

1894. *Lepus sylvaticus mearnsi* Allen, Bulletin American Museum Natural History, vol. 6, p. 171.

1899. *Lepus floridanus mearnsi* Allen, Ibid., vol. 12, p. 13.

Type locality.—Fort Snelling, Hennepin Co., Minnesota.

Faunal distribution.—"The eastern prairie cottontail is a member of the eastern prairie fauna of the transition and upper austral zones. It would, therefore, not come within the scope of the present paper had it not recently extended its range as far as Toronto, Ontario and central New York."—See Miller, Key to Land Mammals of Northeastern North America, 1900, p. 119. Examination of specimens from northwestern Pa. show this to be the form of cottontail now living in the transition and deforested Canadian zones in that region. It intergrades on the west slope of the Alleghenies with *transitionalis*, and probably in the southeastern (Ohio valley) lowlands of Pa. with *mallurus*.

Records, habits, description of species, etc.—See under next race, *L. f. mallurus*.

Southeastern, or Lowland Cottontail or Rabbit. *Lepus floridanus mallurus* (Thomas).

1898. *L.[epus] n.[uttalli] mallurus* Thomas, Annals and Magazine Natural History, 7th series, vol. 2, p. 320.

1899. *Lepus floridanus mallurus* Allen, Bulletin American Museum Natural History, vol. 12, p. 13.

Type locality.—Raleigh, Wake Co., N. Carolina.

Faunal distribution.—Austral zones; Atlantic Ocean, to and including Mississippi Valley; southeastern N. York to Georgia.

Distribution in Pa. and N. J.—This is the abundant and well known rabbit of the lowlands of our State. Above elevations of approximately 1000 ft. it

begins to grade into the larger, paler form of cottontail known technically as *transitionalis* east of the great Alleghenian watershed. West of that range in the northern drainage of the Allegheny River and of Lake Erie it grades into the pale-rumped race, *mearnsi*.

Habits, etc.—"Brer Rabbit" is as well known to old and young as some of our best friends. The three divisions of his family now made by hair-splitting naturalists seem to have made no alteration in his manners wherever found. Being ever ready to explore and develop new fields, he has followed closely on the heels of "the man with an axe" and assumed "squatter sovereignty" with timid nonchalance born of persecution. The meek shall indeed inherit the earth, in proportion as they "be fruitful and multiply and replenish" it. Let us go to the rabbit, consider his ways, and be wise.

Description of species.—I use the following guide to the three races of cottontail found in our limits from Miller's Key: 1. General color bright yellowish brown with a strong admixture of black; a distinct black spot between ears = *L. f. transitionalis*. 2. General color pale yellowish brown with very faint admixture of black; no black spot between ears; rump noticeably paler than back, hind foot often over 100 millimeters (4 in.) = *L. f. mearsni*. 3. Same general colors as *mearnsi*, but rump noticeably paler than back and hind foot generally under 100 mm. (4 in.) = *L. f. mallurus*. There is a large area of debatable ground in the Alleghanies, especially in the common watershed of the Allegheny and Susquehanna rivers, and in the southern ridge where it enters Maryland, in which the mixture of the three forms is puzzling, but most typical *transitionalis* occurs in the mountains of central and northeastern Pa., *mearnsi* in Erie and Crawford Cos. and *mallurus* in the lower Delaware, Susquehanna and upper Ohio valleys. Series from these three localities, all taken at the same season, are readily separable into the races named.

Measurements.—(From Miller) (*transitionalis*) total length, 430 mm. (17 in.); tail, 55 (2⅛); hind foot, 95 (3¾); *mearnsi*—475 (18¾); 65 (2½); 100 (4); *mallurus*—430 (17); 55 (2⅛); 95 (3¾).

Order PINNIPEDIA; Seals.

Family PHOCIDÆ; Earless Seals.

Genus *Phoca* Linnaeus, Systema Naturae, 1758, vol. 1, p. 37.

Harbor Seal; Sea Dog. *Phoca vitulina* Linnaeus.

1758. *Phoca vitulina* Linnaeus, Systema Naturae, 1758, vol. 1, p. 37.
Type locality.—Europe.
Faunal distribution.—Waters, islands and bays of the north Atlantic Ocean;

wandering south in winter to North Carolina along the east Atlantic coasts; occasionally ascending rivers.

Distribution in Pa. and N. J.—Now and then found in Delaware Bay and river up to the rocks at Trenton Falls. Often noted in winter along the entire N. J. coast. Numerous in the waters of northeastern N. J., New York Bay and Hudson River at the same season.

Records in Pa. and N. J.—As all the following records from the Delaware River may refer to both states in a faunal sense, they will not be separated:

Delaware River.—The following is extracted from Allen's Monograph of North American Pinnipeds, 1880, pp. 585, 586: "Dr. C. C. Abbott, the well-known naturalist of Trenton, N. J., kindly writes me: 'In going over my note books I find I have there recorded the occurrence of seals (*Phoca vitulina*) at Trenton, N. J., as follows: December, 1861; January, 1864; December, 1866; February, 1870, and December, 1877. In [each of] these 5 instances a single specimen was killed on the ledge of rocks crossing the river here and forming the rapids. In December, 1861, three were seen, and two in February, 1870. A week later one was captured down the river near Bristol, Bucks Co., Pa. My impression is that in severe winters they are really much more abundant in the Delaware River than is supposed. Considering how small a chance there is of their being seen when the river is choked with ice, I am disposed to believe that an occasional pair or more come up the river even as high as Trenton, the head of tide water, and 138 miles from the ocean. On examination of old local histories, I find references to seals as not uncommon along our coast and as quite frequently wandering up our rivers in winter. In conversation with an old fisherman, now 76 years old, who has always lived near Trenton and has been a good observer, I learn that every winter, years ago, it was expected that one or more seals would be killed and that about 1840, two were killed in March, which were supposed to have accompanied a school of herring up the river. In my investigations in local archæology, I have found in some of the fresh-water shell heaps, or rather camp fire and fishing village sites along the river, fragments of bones which were at the time identified as those of seals. These gave me the impression that the seal, like many of our large mammals, had disappeared gradually as the country became more densely settled, and that in pre-European times it was common, at certain seasons, both on the coast and inland.'" Dr. Allen subsequently received from Dr. Abbott records of the capture of 8 more seals in New Jersey, mostly near Trenton, during the winter of 1878–79. In Watson's Annals is recorded a seal 4 ft. 4 in. long, weighing 61 lbs., which was captured in 1824 near the Repaupo (Gloucester Co.) flood gates, while another approached the limits of Pa. (Chester Co.) by ascending the Elk River, Maryland. De Kay, in his Zoölogy of New York, states that formerly they were taken almost every year in the "fyke nets" in the Passaic River, N. J.,

Hudson and Essex Cos., greatly to the disgust of the fishermen, because they destroyed the nets.

In the "North American" (Philadelphia newspaper), under date of October 20, 1901, a despatch from Trenton, N. J., says: "A spotted seal, 6 ft. 10 in. long, was caught in the Delaware River here yesterday by William Hill and Joseph Springard, two sixth-ward fishermen. The men shot the animal when it appeared alongside their rowboat."

Warren records a seal, probably this species, "taken in the Delaware River two years ago [1895] at Chester City, Delaware Co.," Pa.—Poultry Book, p. 317.

Regarding its occurrence on the N. J. coast, I find on inquiry among fishermen that it is frequently seen, sometimes shot and sometimes captured accidentally in seines. I have seen two dead and one live one at Atlantic City in the last 10 years. Dr. T. P. Price, of Tuckerton, recently informed me that H. Shourds has seen about a dozen altogether in Tuckerton Bay and that B. Chew saw one at Deep Point, Mullica River. Mr. H. W. Hand says 1 or 2 are seen or shot in Cape May Co. waters yearly. Mr. W. S. Williams writes that he saw one about 1890 feeding in his shad net in Cohansey Creek, presumably near Greenwich, Cumberland Co. It was allowed to escape for fear of breaking the seine.

Habits, etc.—This is the only American species known to wander voluntarily into fresh water in pursuit of fish. In so doing it gets into the fresh water lakes of New York, hundreds of miles from salt water. In Pa. and N. J. it is known only as a winter or fall migrant from its summer home off the coasts of northern New England and farther north. In these regions it inhabits the rocky reefs and outlying islands of the coasts, there bringing forth its single young. Its food consists of fish; the flesh and skins of the young are much prized by the aborigines. It is exceedingly wary where hunted and difficult to kill with shot. Its commercial importance was always small.

Description of species.—Color variable. Usually yellowish gray varied with irregular spots of dark brown, smaller on the underside than on back. Sometimes without dark spots, sometimes dark, streaked irregularly with lighter color. It can be distinguished from the other two rarer species found in our limits by its color and smaller size. Its total length when adult is about 5 feet.

Harp Seal. *Phoca groenlandica* Erxleben.

1777. *Phoca groenlandica* Erxleben, Systema Regni Animalium, vol. 1, p. 588.

Type locality.—Greenland and Newfoundland.

Faunal distribution.—Circumpolar seas, south along the east coast of

America normally to the Magdalen Islands, fortuitously to New England and New Jersey.

Distribution in Pa. and N. J.—The only record of the occurrence of this seal in our limits rests solely on the following mention made by Dr. J. A. Allen in his Monograph, above cited, page 640: "I have, however, recently been informed by Dr. C. C. Abbott, of New Jersey, that a seal, described to him as being about 6 feet long, white, with a broad black band along each side of the back, was taken near Trenton in that state during the winter of 1878–79. This description can of course refer to no other species than *Phoca groenlandica*, and as it comes from a wholly trustworthy source it seems to substantiate the occasional occurrence of this species as far south as New Jersey."

I have written Dr. Abbott for further particulars regarding this record, but he answers that he finds no reference to it in his note books, and that his memory does not serve him reliably enough at this late date to add anything to the data given by Dr. Allen.—Rhoads, 1902.

Habits, etc.—This species forms the bulk of the sealing industry in the east Atlantic. It is very numerous and gregarious, breeding off the coast of Newfoundland. It is unsuspicious and easily killed. It never is found numerous except in the vicinity of ice.

Description of species.—The Harp seal is so named from its distinctive color markings, the male having a black face and a harp-shaped, irregular band of black almost encircling the back, crossing below the neck and nearly meeting at the rump. This is in contrast to a nearly white background. The female is but slightly mottled with black. Length, 5 to 5½ feet.

Genus *Cystophora* Nilsson, Skandinav. Fauna, vol. 1, p. 382.

Hooded Seal; Bladdernose. *Cystophora cristata* (Erxleben).

1777. *Phoca cristata* Erxleben, Systema Regni Animal., vol. 1, p. 590.

1841. *Cystophora cristata* Nilsson, Wiegmann's Archiv. f Naturges., vol. 8, bd. 1, p. 326.

Type locality.—Southern Greenland and Newfoundland.

Faunal distribution.—"Restricted to colder parts of the North Atlantic and to portions of the Arctic Sea."

Distribution in Pa. and N. J.—Occasional straggler on the N. J. coast; recorded two or three times from as far south as Chesapeake Bay in Maryland.

Record in N. J.—The following is the only record of this species in our limits. I quote from the American Naturalist of Nov., 1883, pp. 1191, 1192: "*Mammals.*—Mr. A. E. Brown writes to *Forest and Stream* concerning the capture of the hooded seal near Spring lake, New Jersey, which was forwarded to the Zoölogical Garden at Philadelphia: 'It was in poor condition when

received, steadily refused food, and died on the ninth day after arrival, when its incisor dentition ($\frac{2\cdot2}{1\cdot1}$), the large development of claws on the hind feet, with other details, proved it to be a young female hooded seal (*Cystophora cristata*). Although a few specimens of this seal have been seen on our shores, even as far south as the Chesapeake, yet its occurrence is sufficiently rare to be worthy of note, and at this season of the year it may be inferred that a considerable part, at least, of the voyage was performed on an iceberg or floe. The short life of the animal gave little chance to observe peculiarities of habit, the only ones observed being its extremely savage disposition, to a degree far greater than I have ever seen in the common seal, and its habit of floating in the water with the axis of the body almost perpendicular instead of horizontal, as with most other seals. Both of these habits I find to be mentioned by those who have observed the animal under motion. It is much to be regretted that the specimen did not live, as its presence in the same pond with specimens of three other North American seals, the common seal (*Phoca vitulina*), the California elephant seal (*Macrorhinus angustirostris*), and Gillespie's hair seal (*Zalophus californianus*), would have offered a rare opportunity for studying the moral differences of these species. It is curious to observe that the habit of floating perpendicularly, above referred to, is shared by it with the sea elephant, which it resembles in dentition, and quite strikingly in internal anatomy, the two genera forming a group quite apart in subordinate characters from the other Phocidæ.'"

This animal was sent to the Zoölogical Garden by I. Roberts Newkirk of Philadelphia.

Habits, etc.—This species, like the harp seal, is by preference a dweller on the drift ice of the high seas, away from rocky islands or shores. It is combative and quarrelsome and exceedingly difficult to kill. It feeds on fish, crustaceans and mollusks. Owing to its scarcity it has a small commercial value.

Description of species.—Head and limbs nearly uniform black. Color above bluish black varied with small whitish patches, lighter beneath. Male with head surmounted by a movable muscular bag, extending from nose to behind the eyes, and about a foot long. Length of old male 7½ to 8 feet.

Order FERAE: Carnivores or Flesh Eaters.

Family FELIDÆ; Cats.

Genus *Felis* Linnaeus, Systema Naturae, 1758, vol. 1, p. 41.

Alleghenian Cougar; "Panther." *Felis couguar* Kerr.

1792. *Felis couguar* Kerr, Animal Kingdom, p. 151.

Type locality.—Pennsylvania.

Faunal distribution.—Northeastern United States, intergrading in Florida and Louisiana into *F. c. coryi* (Bangs), in western Texas into *F. c. aztecus* (Merriam), in the Rocky Mountains into *F. c. hippolestes* (Merriam) and in the Cascade Mts. into *F. c. oregonensis* (Rafinesque).

Distribution in Pa. and N. J.—Originally found in every part of both states, but always more abundant in the Alleghany mountains. In N. J. it became extinct in the early part of the 19th century, the last probably occurring in Sussex or Warren Cos. as strays from northeastern Pa. No dates of their extinction in N. J. have been secured. In Pa. they have not been killed, so far as I can substantiate the accounts which have been published, since 1871, though one statement would imply that 2 had been killed in Clinton or Clearfield Co. in 1891.

Records in Pa.—Bedford, Blair and Huntingdon Cos.—"Among the mountains of the headwaters of the Juniata River, as we were informed, the Congar is so abundant that one man has killed for some years from 2 to 5, and one very hard winter, 7." It has 3 or 4 young, 5 are a rare exception. The usual number is 2.—Audubon and Bachman, Quad. N. Amer., 1851, vol. 2, p. 311.

Berks Co.—"Last Wednesday" a panther was killed in Albany township in the Blue Mountains by Thomas Anson. Weight 146 lbs. Length, 4 ft. 5½ inches, plus 2 feet of tail. Mr. Pfleger was also in the party. Signed, O. D. S., Hamburg, Berks Co., Aug. 10, 1874.—See Forest and Stream, 1874, vol. 3, p. 67.

Bradford Co.—"Dr. W. S. Lewis, of Canton, tells me that Post. Wilcox, a grandson of Sheff. Wilcox, when a boy fifteen years old, in the winter of 1858, killed a panther in Albany Twp. The doctor gives the particulars of the hunt for the panther. I have no doubt of the truth of his statement."—Cleveland, 1901. "Mr. A. D. McCrassey, who is at present Chief of Police of Canton borough, informs me that, in 1869, with his wife, and a Mr. Northrop and his wife, while taking a Sunday after-dinner stroll along the track of the Barclay R. R., not far from Greenwood, Bradford Co., Pa., an animal jumped on the track a few rods in front of them, halted, turned and looked at them a moment, then disappeared in the woods, making tremendous leaps. Description: light yellow color, body five feet long, tail apparently as long as its body; head, large and round; ears, short and erect; eyes, large, round and glaring. Mr. McCrassey does not name the animal."—Cleveland, 1901.

Cambria Co.—Panthers are stated by Hallock to be found near Ebensburg in 1877. See Sportsman's Gazetteer, 1877, p. 140. On Stony Creek, 12 miles from Johnstown, a Mr. Kauffman and companion found a mangled sheep from which they tracked a panther to a nearby ledge, from which, with dogs, they dislodged it. It took refuge in a cave close by after being wounded. Digging down to the cave from above, they killed it. This was about the year 1875.—Shields, 1901.

Cameron Co.—None have been killed in 20 years in the Emporium region. Larrabee, 1896. "The last date of a panther that I can give is of the two killed down on the Driftwood, between Stirling and Driftwood, in 1851, by Isaac Rammage, who was an old hunter at that time."—Dickinson, 1901.

Centre Co.—"James Moore killed one in Centre Co. in 1893."—Nelson, 1900. The only specimen of Pa. panther known to me is in the museum of State College at Bellefonte. It was presented to the State by Samuel E. Brush, who shot it in Susquehanna Co., Pa., in 1856. It was exhibited in the Pa. zoölogical display at the Chicago World's Fair, 1892.—Rhoads, fide Friant. A Centre Co. panther is recorded in the table of bounties paid by that Co. in 1886, as given in the book "Diseases and Enemies of Poultry" by Warren, p. 675.

Clearfield and Centre Cos.—The last known to me was killed by James David and Nick Hastings on Big Run of Beech Creek, Clinton Co.—Pfoutz. "Sometime during the year 1871 George Hastings and James David while hunting on Big Run" killed two panthers which their dogs treed, for whose scalps the county paid $12 each. This was in Beech Creek township.—See Maynard's Historical View of Clinton Co., 1875, p. 122.

Relative to the above statements, I give the following letter kindly answering my inquiries of an earlier date under caption of—

"BEECH CREEK, FEB'Y 28TH, 1901.

"*Dear Sir:* Replying to your letter of inquiry of Jan'y 30, 1901, will say the panthers were killed by my brother, George G. Hastings, in December, 1871. The first one was killed on the middle branch of the 'Big Run,' ½ mile above Winslow's Splash dam. Was treed by a large bull-dog. My brother shot it through top of shoulders. It jumped to the ground. The dog caught and held it until my brother ran up and shot it through the head, killing it instantly. The day following the second one was trailed from where the first one was killed to the swamp branch of "Big Run," when the bull-dog was put on the trail. The panther finally took refuge under a large rock. The dog pursued it, caught it, and dragged it forth, when they had a hard fight. The panther succeeded in breaking loose from the dog and sprang up on top of the rock, where it remained in safety until my brother came up and shot it through the heart. This one was killed near the mouth of 'Raccoon Run,' a tributary of the swamp branch of the 'Big Run.' The panthers were male and female. The skins measured from end of nose to end of tail: female, eight feet; male, nine feet.

"Your letter was mislaid, hence the delay in reply.

(Signed) "E. H. HASTINGS."

[P. S.]—"My brother had the panther skins made into a lap robe, which

I think is still in his possession. Any further information he will cheerfully give you. His address is George G. Hastings, Bellefonte, Pa."

"There may be one or two in Clearfield Co., but the Askey boys and I killed two 2 years ago."—Nelson, 1893. "Those panther skins, with two others, went to Germany with a lot of other furs, by Schreader & Co. I did not kill the panther; it got in my bear trap, and was dead when I came to the trap."—Nelson, 1895.

Crawford Co.—"In 1833, J. and P. Vasbinder killed 3 on Boone's Mountain."—McKnight's History Crawf. Co., 1898.

Elk Co.—Last one killed nearly 40 years ago in Elk Co.—Luhr. Found near Ridgway as late as 1877.—Hallock, Sportsman's Gazetteer, 1877, p. 140.

Forest Co.—"Formerly numerous in Kingsley Twp. and at Panther Rocks, 15 miles above Tionesta on French Creek. Last killed about 1848."—Irwin.

Lancaster Co.—About 1830, a stray panther was seen or supposed to have been seen.—See Rathvon's Hist. Lanc. Co., 1869, p. 501.

Luzerne Co.—From 1808 to 1820, Luzerne Co. paid bounties on panther scalps, $1822.—upwards of 50 being killed in 1 year. "There are no panthers in this county at present, except occasionally one may be met with in the great swamps or on the North Mountain."—Pearce, Annals Luzerne Co., 1860, pp. 489, 490.

Lycoming Co.—"About this time [1840] a Dr. Reinwalt was called from his home at Liberty Corners, Tioga Co., to visit a patient at English Center, Lycoming Co., five miles distant. The Dr. went on first, taking his gun with him, a double-barreled rifle, and as he did not return when expected, a party went in search; but as a heavy body of snow had fallen before the search began, his body was not found for nearly two weeks. It was lying near a large butternut tree. The wounds on the body indicated that a panther had killed him. One barrel of his gun had been discharged and the other barrel had missed fire. The inference was, that a panther was perched on a horizontal limb of the butternut tree when discovered by the doctor, that a shot from his rifle wounded the brute, when it sprang from the limb upon the unfortunate man.

"Liberty, or what is more generally known as the Block-House, from a house built of hewn logs by the first settlers, as a protection from the Indians, was settled by the Germans, or Pennsylvania Dutch. They were a superstitious people, and believed in witchcraft. If a good marksman made a poor shot, he attributed his poor luck to witchcraft, and applied the remedy: shooting a silver ball from his gun. The winter following the doctor's death, Jacob Sechrist and a Mr. Messner, while hunting deer, discovered the trail of a panther, and presuming that they had found the track of the brute that had killed their friend, Dr. Reinwalt, they vowed vengeance. Returning home for provisions, the next morning, with their witch-proof rifles, they took the

trail, and camping on the track when night overtook them, on the fourth day they killed the panther, on the mountain east of the Loyalsock Creek, in Sullivan county, Pa., near Hillsgrove. They found ball in shoulder, probably from the doctor's gun."—Cleveland, 1901.

McKean Co.—The last one killed was by Eastman and Smith, about 1858 or '59.—Dickeson.

Mifflin Co.—"About 45 years ago [1854?] one was killed in the Seven Mountains near Milroy. I saw the stuffed skin shortly after."—Rothrock' 1900.

Monroe and Pike Cos.—"A panther, I am assured by Mr. Eilenberger, has not been killed in Pike Co. for 30 years, all reports to the contrary notwithstanding."—Rhoads, Proc. A. N. Sci., Phila., 1894, p. 393. In October, 1873, two were seen in Pike Co.—Forest and Stream, vol. 1, p. 141.

Northampton Co.—In 1827 a panther was killed 17 miles from Easton.—See Watson's Annals, 1830.

Potter Co.—" I have not heard or seen a panther in 4 or 5 years."—N. P. Francis, Potter Co., 1893. All gone in Potter Co. Last killed many years ago. I know of only 1 killed in this Co., viz., in 1841 by Henry Hurlburt.—Austin, 1901.

Sullivan Co.—" Now rare. The county treasurer's report for 1834 showed $300 paid for wolf and panther scalps " that year.—R. C. Taylor, Loudon's Mag. N. Hist., 1835, vol. 8, pp. 536 to 539. " My father killed the last one in this region certainly known to me between the years 1855 and 1860."—Bennett. "About 1873 I heard of one being killed in Sullivan Co. W. B. Lyon of Tioga Co. saw one the same year."—Cleveland. " One was killed in Sullivan Co. near the Luzerne line about 3 years ago [1857].—Pearce, Annals Luzerne Co., 1860, p. 490.

Susquehanna Co.—Last one killed in the Co. by a Mr. Orin, near Clifford, in 1874.—Stevens. " I remounted a specimen shot by Samuel E. Brush of Susquehanna, Susq. Co., in 1856. It was shot in the same Co., and was remounted for the Chicago World's Fair, Penna. exhibit. It measured 7 ft. 9 in. in length, was 30 inches high at shoulders, and weighed 147 lbs. when shot. It was a rare species when captured. Now it is wholly extinct in the Co."—Friant, 1901. Mr. Friant tells me that Dr. B. H. Warren and himself persuaded Mr. Brush to give the specimen to State College, Bellefonte, Pa., for sake of its preservation. It is now there. The skull is in the specimen, and the mouth is open so that its dental characters may be determined. The skin is in fair condition, and not bleached by exposure and age.

Tioga Co.—" About the year 1840, Jacob Seachrist with his nephew, John Seachrist, who was then a boy, were hunting stray cattle on Briar Hill in Liberty Twp. They had three dogs with them. The dogs got after a panther, and drove it up a tree. Jacob shot the panther, but before it died it killed

one of the dogs, and seriously wounded another."—Cleveland, 1901. "In relation to the panther seen by W. R. Lyon, Esq., late of Ward, Tioga Co., Pa., Mr. Lyon was a hunter of large experience and a man of truth and veracity. I got the date from his son, S. W. Lyon, a merchant of Canton, Pa. In the winter of 1864 Mr. Lyon was returning home from Fall Brook, a distance of four miles through the woods, when he discovered an animal moving leisurely up a ravine toward the highway. When it reached the bridge that spanned the gulf, it hesitated to cross the road, but when it saw Mr. Lyon, who was standing about thirty yards from the bridge, it retreated with speed across the ravine. Mr. Lyon told me that the panther was in plain sight for several minutes; that he examined the tracks made in the snow, and that he was positive that it was a panther."—Cleveland, 1901.

Wyoming Co.—"My father killed the last one, before my time."—Robinson.

York Co.—One was killed at Shrewsbury in 1729. See Watson's Annals, 1830, under "Game."

Records in N. J.—So far as can be ascertained by meagre and unsatisfactory returns from my correspondents, the last N. J. panther was destroyed about the third or fourth decade of the 19th century (1830 to 1840). It is probable that the last specimens lingered in the swamps of Cape May, Ocean and Atlantic Cos. The only other part of the state where they may have lingered so late would be Warren and Sussex Cos., along the upper Delaware Valley, opposite Pike Co., Pa.—Rhoads.

Burlington Co.—In 1748, an Indian killed a panther, which had just struck down a buck deer, near Crosswicks.—See Smith's Hist. of N. J., ed. 1879, p. 503.

Camden Co.—See quotations beyond from county treasurer records of Ebenezer Hopkins, under article on the gray wolf.—Rhoads.

Cape May Co.—"Though it is impossible to get instance or records, the concurrent testimony in Cape May Co. among old hunters proves that panthers were often found there 50 or 60 years ago. My grandmother remembers one being killed in this Co. about 70 years ago."—Hand, 1900.

Mercer Co.—The bones of panthers are found in Indian refuse heaps in the vicinity of Trenton.—Abbott, 1900.

"*West Jersey.*"—The General Assembly of West Jersey convened at Burlington, Nov. 4, 1697, enacted a bounty law for the extermination of wolves and panthers on the following grounds: "It being seen by daily and detrimental experience that the wolves are very destructive to the cattle and creatures of the inhabitants of this Province, and it being represented that the panthers are also great destroyers of stock," etc. The bounty to "whatsoever Christian shall kill and bring the head of a wolf of prey or panther to any magistrate of any county of this Province" was 20 shillings. Negroes and

Indians only received half this sum. A non-preying young wolf or panther was only worth half as much bounty as an adult.—Lee.

After the "Union of East and West Jersey," in 1702, the legislature passed a law (1709) for the destruction of these animals. In 1730, the bounty on wolves was made 20 shillings and on panthers 15 shillings, whelps 5 shillings. This was soon increased to 60 shillings for adult wolves and 10 shillings for whelps. The panther nuisance had undoubtedly greatly abated by that date.—Lee.

Habits, etc.—The following may be given as an epitome of the habits of an animal never understood by the masses and concerning which so much has been published of a fictitious character. The recent account of the Cougars of Colorado, published in "Scribner's Magazine" (1901), by Theodore Roosevelt, is one of the best from the standpoint of the hunter, and in some respects, from that of the naturalist. He, however, minimizes too greatly the ferocity of the beast on certain occasions, and seems to be unduly skeptical as to their making an occasional unprovoked attack on man and their habit of leaping from trees, rocks, logs or other vantage-points where they have laid in wait for game. These habits of the animal have been testified of by observers whose competent judgment, experience and veracity are as much to be relied upon as that of those who in these latter days are so ready to disprove the statements of their ancestors in the chase, the laboratory and the field of literature.

The *character* of the cougar is eminently cowardly, sneaking, thievish, but often courageous when with young. When starved, it is emboldened to follow and (very rarely) attack a man. It may be fenced off when wounded by the courageous use of a stick or gun barrel, but sometimes leaps upon its assailant. It never seems to realize its power of offense or defense, and a well-trained cur will inspire it with terror and quickly tree it.

It hunts by lying in wait, prowling and stalking. The larger game, as deer, are approached until within 15 or 20 yards and then overtaken by a succession of quick bounds, sometimes clearing 20 to 30 feet at a leap, springing on the back, clasping the neck and shoulders, and biting the neck until the animal falls. Smaller animals are struck down by the paw and throttled. It drags its prey when unable to carry it clear of the ground in its mouth, hiding it after the first meal and returning nightly to it for food. Sometimes, when game is plenty, they kill and suck the blood of several without eating the carcass. Their favorite food is the deer, but they kill heifers, colts, calves, sheep, hogs, larger game, birds, fish, porcupines, skunks, opossums, in fact any animal large enough to claim attention. Their favorite haunts are in mountains where rock caverns and ledges abound, but all primeval situations afford them the requirements of a habitat. They do not hibernate. The young, born in March, are laid in a bed of leaves in a cavern or hollow log,

and generally number 2, often 3, rarely 4. The male and female do not associate after the birth of the young, but often hunt together before that season, assisting each other in the destruction of large game. When engrossed in catching deer, or in the excitement of killing or first eating their victim, their innate fear of man vanishes. Godman relates how a pair in Centre Co., Pa., pursued a wounded buck before the hunter could overtake it and were killing it when the hunter arrived on the scene. Though he shot and killed the female, the male continued to throttle the deer and was shot 3 times in fatal parts of the body while facing the hunter on the same spot; the buck meanwhile, having stumbled over it, regained its feet and ran off. When chased by dogs, they sometimes leap directly from the ground to the lower branches of a tree and thus ascend, but if forced to climb a tree whose limbs are out of leaping reach, they go up the trunk precisely as does a cat, by short, clinging jumps. The voice of the male panther, so far as I have observed it in the Philadelphia Zoölogical Garden, is capable of most of the gradations and tones of the domestic cat, and has a great similarity thereto in purring, mewing, caterwauling and spitting notes. Multiply cat-calls by ten and you get the kind of noises that have done more than anything else to give the "American Lion" its reputation for qualities which it does not possess. Roosevelt says that the sounds made by those hunted by him were low growls and snarls with, rarely, a thunderous growl. They make no sounds which could be compared with the roaring of lions, that we have account of.

Description of species.—Until recently, all of the animals in America styled "Pumas, Cougars, Panthers and Mountain Lions," were classed by naturalists under one scientific name, *Felis concolor*. As this binomial was given by Linnæus to a Brazilian specimen, and North American specimens had proved to differ from those of South America in some degree, the modern naturalist became restive. Only the lack of material for comparisons and the tedious searching in the dusty tomes of nomenclature, characteristic of the priority-hunting of to-day, had deterred the hair-splitters from putting forth a few more old and familiar cougars in the rôle of new species and subspecies. Some of these, alas, must receive old discarded names long languishing on the perennial bosom of synonymy!

Dr. Merriam had already described, ere his "Revision of the Pumas" (Proc. Washn. Acad. Sciences, 1901) came forth, a species, *F. hippolestes*, from Wyoming, and a race *F. h. olympus*, from the Pacific coast. These he has retained, and has adopted *couguar* of Kerr as a separate species from the Rocky Mountain *hippolestes*. With the latter determination I must at present differ, as he has given no evidence that there is any specific difference between the Alleghenian and the Rocky Mountain animals. Owing to his having a fine series of skulls and skin-data of the latter and only two unsexed skulls of the former, he can present no absolute proof that his hypothesis of

the larger relative size of *hippolestes* skulls is correct. But even if this is the state of the case, size alone, without dental and cranial differences, such as separate species in other of the *Felidæ*, does not warrant the continuance of *hippolestes* as a species. As Dr. Merriam has not indicated such departures in the skulls he examined, it is not likely they exist or that he would have overlooked them. On the same basis, I am unable to note that he has made a good *specific* case for any one of the North American forms named in his paper. Therefore, as *F. couguar* is by priority to be made the type of the North American puma group included in his Revision, and as all the members of that group are (or were in the last 50 years) geographically connected by a continuous distribution in the United States and Mexico, it behooves us, until a more satisfactory series of specimens be studied, that the nomenclature of these races should stand as I have placed them in the early part of this article.

The following are the characters given by Merriam for Adirondack specimens: "Size medium, head (apparently) disproportionately small for size of body; color, dull fulvous; skull, smallest of the known species. Color: 'Body and legs of a uniform fulvous or tawny hue. Ears light colored within, blackish behind. Belly pale reddish, or reddish-white. Face sometimes with a uniform lighter tint than the general hue of the body.'—De Kay. Skull smaller and less massive than in any other North American species; nasals broader and blunter posteriorly than in *hippolestes* and *aztecus*, but very much smaller and narrower than in *coryi* from Florida; bullæ smaller; basioccipital broader, teeth smaller and more slender, particularly the large upper premolars (carnassial and pm $\frac{2}{2}$)." It is probable on zoö-geographical grounds that not only do the Adirondack cougars average smaller than typical Pa. specimens, but that if a series of the latter, showing by their sagittaal crest development the great age of animal from which the skull was taken (as was the case with some of the Roosevelt series of *hippolestes*), were compared with *hippolestes*, the differences, which Merriam qualifies by the term "apparently," would largely fall to the ground.

I have written without success to obtain a description of the Pa. panther in State College museum. Its body measurements have been already given as taken from the stuffed specimen. The lengths of Pa. cougars usually given in historic accounts are generally overestimated, often grossly so. It will be found, however, on comparing the more reliable accounts of the size of United States cougars that the differences, while favoring the usual rule of greatest size in north temperate latitudes, diminishing toward the Gulf and Mexico, are not great, and that some of the largest panthers ever taken have been killed in Pennsylvania and Louisiana (Red River, See Doughty's Cabinet, N. Hist., vol. 2). In the Roosevelt series from Colorado the average total length of 3 males and 3 females, all adult, was 7 feet 2 inches, the largest male being 8 feet long, the largest female 7 feet long. This large male was fat and weighed 227 pounds.

Genus *Lynx* Kerr, Animal Kingdom, 1792, vol. 1. Systematic catalog. inserted between pp. 32 & 33; description on p. 157.

East Canadian Lynx. *Lynx canadensis* Kerr.

1792. *Lynx canadensis* Kerr, Animal Kingdom, same reference as above for genus.

Type locality.—Eastern Canada.

Faunal distribution.—Canadian, Hudsonian and Arctic zones; Atlantic Ocean to Rocky Mountains.

Distribution in Pa. and N. J.—Always a rare species in even the most boreal parts of Pa. I have no certain record from northern N. J., but it probably straggled occasionally in former times into the most northern counties. It is now practically exterminated within our entire limits. In the higher Alleghanies it once reached the southern border of Pa.

Records in Pa.—Cameron Co.—"Mr. Larrabee, who recognized the specific distinction between [wild cat and lynx] told me [in 1896] that he knew certainly of the capture of one in Cameron or Potter Co. within 16 years."—Rhoads, Proc. A. N. S., Phila., 1897, p. 222.

Columbia Co.—"I killed one 50 years ago [1849] in Columbia Co. Know of none since."—Buckalew, 1899.

Forest Co.—"It is 50 years since I saw one."—Haslet, 1900.

Lackawanna Co.—I have examined a specimen of lynx in the private collection of E. W. Campbell, West Pittston, Pa. This specimen is a male in the summer coat. The size is not great but the teeth indicate an adult in early prime. The ears are tipped with stiff, bristling, black hairs or tufts about 1½ inches long, their points being considerably worn. The tail is short, and the feet relatively large as in Canada lynx as contrasted with bay lynx. The color is a dull reddish gray, unspotted above, and a conspicuous ruff surrounds the sides of neck. The lynx was killed, so I am informed by Mr. Campbell, in late September, 1881, by Jesse Weaver in a timber tract where he was chopping, in the mountains near the Welch Settlement, Spring Brook township. The lynx was discovered lying on a tree limb and shot. Another specimen of half grown lynx in Mr. Campbell's collection, taken later at Ash Gap, Lehigh River, by C. Donnelly and in winter fur, is of such a light gray spotless color that there is a probability that it is a *L. canadensis*. It has ear tufts almost as large as in adult *L. ruffus*. The following measurements, among many others taken from this mounted specimen and kindly furnished by Mr. Campbell, indicate it to be a lynx and not a wild cat: Total length, 3 ft. 4 in.; tail vertebæ, 4½ in.; ear pencil, above ear tip, 1½ in.; hind foot from end of longest toe to heel, measured along sole, 8¼ in.; width of hind foot pads, 3¼ in., length, 4¼; front foot, 3½x3 in.

Lycoming Co.—One was killed near Roaring Branch in 1896.—Babcock.

McKean Co.—"The following circumstantial account of the capture of a lynx by an old Pa. hunter of long experience should remove any doubts as to the former existence of *L. canadensis* in Pa.:

JAMESTOWN, N. Y., *Nov. 30, 1899.*

SAMUEL N. RHOADS, ESQ.

Dear Sir: I notice [in a local newspaper] an article inviting any person having knowledge of certain animals found in Pennsylvania subject to extinction to give a brief account of same. I had a camp on Kinzua Creek, McKean Co., Pa., where my partner and I spent twelve falls hunting and trapping, from 1855 to 1867. In Dec., 1867, I killed a deer and hung the fore quarters up on a tree as high as I could reach, taking the saddle into camp. The next evening but one I came that way and found that some animal of the cat kind had come within about 10 feet of the tree and sprung upon the meat; had made a meal and jumped back into and followed away on the same tracks by which it came. * * * Next morning I went back and set a trap in the place where he left the ground to make his spring. The third morning after I found my trap and clog gone and following up the trail found him up a hemlock tree about 30 feet from the ground, trap and all. The chain was wound around a large limb twice, and he hanging by one fore leg caught in the trap, dead, frozen stiff. I went back to camp, got an axe and cut the tree down to secure trap and game. I found a nice specimen of Canadian Lynx, weighing about 40 lbs. I judged so by hefting and comparing him with my still-hunting dog whose weight I knew. I took his pelt off and sold it with my other hides, not realizing that it was of any particular value as a specimen. It was considerably taller on legs than a wildcat, longer body, of a light gray, tail 6 to 8 inches in length, and the funniest thing about it was its ears, which had stiff black hairs coming out from the inside of the ear, and growing up and coming to a point at the end of the ears, then twisting around like an old-fashioned horse-hair fish line for about ¾ of an inch. Right atop of this was formed a round ball of the black hair about as big as a blue plum, so that when you held the head up and shook it a little, the little bells on top of the ears would jump around in all shapes. Another hunter that lives in that vicinity by the name of Aaron Parmeter, post office address Kinzua, Warren Co., Pa., killed one about the same date while he was watching for deer at a salt lick one evening. I have not hunted any in Pa. for the past 25 years, but I think that they still exist in N. W. Pennsylvania, and that a specimen can be had even now. * * *

"Respectfully yours, THOS. J. FENTON."

"The Lynx was never plenty in northwestern Pennsylvania. My father,

Edward Dickinson, caught two in Norwich township on the west branch of Potato Creek. One in 1842 or '43, and one in 1851 or '52. My father and I caught one in Nov.. 1867. This one was an old tom cat and showed all signs of old age. This one is the last genuine lynx that I know of being caught in McKean Co. We have a cat here yet that is called a lynx, because of its size and color. Some of them will weigh as high as forty-four pounds. But they are a darker gray than the lynx. I believe they are a cross between the lynx and the common wildcat. A large wildcat will weigh from twenty-four to thirty pounds."—Dickinson, 1901.

"I have not seen a specimen of lynx in 30 years. It used to range over this region in the head waters of the Susquehanna and Allegheny Rivers."—Dickeson, 1900.

Monroe and Pike Cos.—"Many residents near Porter's Lake assured me that this species is occasionally trapped in that vicinity. The occurrence of the Canadian lynx in these parts is not attested by any reliable records known to me."—Rhoads, Proc. Acad. N. Sci., Phila., 1894, p. 393.

Potter Co.—Occasionally a lynx is brought to me for bounty; huge fore legs, gray.—Austin, 1900.

Somerset Co.—The following letter answering more careful inquiry regarding his previous report of having once had a specimen of Somerset Co. Canada lynx, is of interest:

NEW LEXINGTON, Pa., *Dec. 31, 1900.*

MR. S. N. RHOADS, Phila., Pa.

Dear Sir: Yours of the 17th duly recd. In regard to the Canada Lynx which I reported in the circular, I bought the skin from D. C. Barclay and had it tanned at our tannery here and then made into a pair of long driving gloves. Mr. Barclay called it a lynx. It had tufted ears, heavy legs and a tail 6 or 8 inches long. It had an even [unspotted] color which from my recollection was a light gray bordering yellowish. I have seen wildcats both alive and dead and their color is of a much darker gray than this was. And I never saw a wildcat skin (bark tanned, which shrinks them very much) large enough to make a pair of gauntlet gloves such as these were. I have seen Mr. Barclay since receiving your letter; he says "the animal positively, was no wildcat. If it was not a Canada Lynx, then he could not name it." I have the engineer's level at the base of the mountain which is 1837 ft. above sea level. The animal was trapped about 300 ft. above this point, or 2137 ft. above sea level.

Mr. Joseph King, an old man who hunts occasionally, told me to-day that he believes there is another one in the mountain, as he has occasionally seen, during the last several winters, tracks which are much larger than a wildcat track. I am very sorry I cannot find a piece of my old gloves. My wife thinks I gave them away after I had worn much of the fur off.

"I am, yours truly, H. D. MOORE."

Sullivan Co.—Three or four shot here [country between Loyalsock and Pine Creeks, Sullivan, Lycoming and Tioga Cos] in fall [1834]—length 4 ft." As distinguished from wild cat—" 3 feet, spotted."—Taylor, Loudon's Magaz. N. Hist., 1835, vol. 8, pp. 536 to 539. Not known at Eaglesmere.—Bennett, 1896. They say one was killed near Lopez 25 or 30 years ago (1871 to 1876).—Behr.

Tioga Co.—" A description of the Canada Lynx would fit the lynx that I killed in Pennsylvania years ago, except that the Canada Lynx is perhaps ⅙ larger. I have seen the Canada lynx in Minnesota and northern Michigan. I was called professionally to see a lady by the name of McIntosh in McIntosh Hollow on the Tioga River in Ward Township about the time of the War of the Rebellion. The boys came from the woods with a load while I was there and reported a deer killed in their 'sugar-bush' by a panther. The snow was a foot or more deep. I procured a steel trap, and found on examination, when I reached the woods, that a deer had been killed the night before by what I supposed to be a large wild-cat, or catamount, as the larger species of cats were called. The animal had got on the body of a fallen hemlock turned up by its roots, walked its whole length, and climbed on to its roots, about eight feet from the ground. The deer, a medium-sized doe, had been feeding near. The struggle was a fearful one, judging from the blood and area of snow tramped down. I set the trap by the carcass of the dead deer. The next day, when I visited my patient, I went to look at the trap, and found it gone, with its heavy drag. Followed half a mile toward a large swamp, and found trap fast to a lynx, shot it, had the skin dressed and made into a collar that I wore several winters."—Cleveland, 1901.

Wayne Co.—Specimens have been taken in the northern part of this Co. within 7 years.—Stevens, 1899. Very rare in Wayne Co.—Goodnough, 1900.

Over the State.—During the past 5 years I have made very careful inquiries in all sections where the Canada Lynx was reported to be present, but as yet have not been able to discover a true example. There are, however, it is said, two or three well authenticated instances where the Canada Lynx has been taken in Pennsylvania within the last 25 years.—Warren, Poultry Book, 1897, p. 441.

Records in N. J.—None have been received nor probably ever will be at this date, owing to the length of time since they were exterminated and the confusion existing in the minds of hunters as to their identity. That they once existed as stragglers in the northern part of the state is true beyond all reasonable doubt.—Rhoads. Kalm states that the Swedes of N. Jersey recognized the lynx as distinct from the wild cat. One was called the "Warglo" or wolf-lynx, the other "Kattlo" or cat-lynx. The former had been known to kill "stags."—See Kalm's Travels. These remarks of Kalm refer rather indefinitely to N. J., Pa. and N. York.

Habits, etc.—So far as appears from accounts of hunters, there is nothing in the habits of a lynx differing from those of a wild cat except what it accomplishes on account of its greater size and agility. Both these animals appear much more courageous and offensive in their encounters with men and animals than the cougar or panther. They will not hesitate to fasten themselves on the necks of deer, trusting to bring them down by sheer exhaustion and blood-letting before the deer can manage to drag them off by running through brush or the branches of thick trees or by jumping into water. Mr. Seth Nelson on one occasion was trout fishing at a large pool in the woods of Clinton Co. when a crashing through the forest made him seize his rifle in time to shoot both a wild cat and a doe which plunged into the pool to free itself of its tormentor. They have been known to seriously wound hunters in their own defense and even to make an unprovoked attack. Wild cats are one of the greatest scourges of the life of the Pa. forests, as fully revealed in the accounts given by correspondents to Dr. Warren, formerly Pa. State Zoölogist, printed in the book, Diseases of Poultry, published by the Pa. Dept. of Agriculture in 1897. Dr. Warren's account of the life, history and economic status of this animal is by far the fullest, most entertaining, and based on the largest amount of information of any yet published. From this I extract the following facts: "*Favorite haunts:*" Forests, rocky ledges, briary thickets, slashings and bark peelings strewn with decaying logs, fallen trees and brush piles, grown up with rhododendron (buck laurel). *Numbers:* Increasing in Elk, Clearfield, Forest, Cameron, Centre and McKean Cos. where large districts have been deforested. *Food:* Poultry, ruffed grouse, wild turkeys, all other small birds, their eggs and young, deer (especially fawns), lambs, young pigs, rabbits, squirrels, mice, porcupine, skunk, opossum, fish, frogs. *Breeding:* In hollow tree or log in nest made of leaves, moss, etc., some in ledges or caverns. Two to 4 young born in May—(a female containing 3 young nearly ready for birth was sent me April 20, 1897, by S. Nelson.—Rhoads). *Commercial value:* Small, bringing from 35 to 75 cents per pelt. *Bounties:* From 1885 to 1896 a two dollar scalp bounty was paid on wild cats, as per Warren's report. I believe no bounties have since been paid.

Description of species.—The Canada lynx can most certainly be distinguished from the bay lynx or wild cat by the length of its hind foot, meaning by this the length from the end of the longest hind toe to the heel tip (gambrel joint) measured along the under side. Another distinctive feature in adults of *L. canadensis* is the stiff and generally long ear-tips, but as the wild cat has more or less of a tip to its ears this character is somewhat misleading. The great size of the feet and their being thickly furred over the sole in winter is also a peculiarity of *canadensis*. The grayish, hoary, unspotted color of the winter fur of the Canada lynx is quite in contrast to the brownish or reddish gray and spotted or marbled coat of the bay lynx.

Measurements (*canadensis*).—Total length, 1000 mm. (39½ in.); tail vertebræ, 100 (4); hind foot, 225 (8⅞); breadth of front foot about 80 ($3\frac{3}{16}$); (*ruffus*) 900 (35½); 170 (6¾); 180 (7⅛); 50 (2).

Eastern Bay Lynx; Wild Cat. *Lynx ruffus* (Gueldenstaedt).

1776. *Felis ruffus* Gueldenstaedt, Novi. Commentarii Acad. Scient. Imp. Petropolitanæ (1775), vol. 20, p. 484.

1897. *Lynx ruffus* Rhoads, Proceedings Acad. Nat. Sciences, Phila., p. 32.

Type locality.—New York.

Faunal distribution.—Lower Canadian, transition and austral life zones; Maine to Georgia; west to, and including, Mississippi Valley.

Distribution in Pa. and N. J.—Formerly abundant over the entire territory named. Still numerous in the Alleghany region, and locally increasing in the deforested wilderness of northwestern Pa. Exterminated in only 13 of the counties of Pa. Occasionally met with in Mercer, Warren, Passaic, and Sussex Cos., N. J., and supposed to linger in some of the southeastern counties of N. J.

Records in Pa.—Comparing Warren's statistics of bounties and reports from nearly all the counties of Pa. with my own long list of answers from about 40 correspondents in different parts of the state the result is rather surprising. By these it appears that there is only a comparatively small area surrounding and north of Pittsburg, and a somewhat larger area between the foothills of the Blue Ridge Mountains and Philadelphia in which the bay lynx or wild cat has become exterminated. The counties wholly comprised in these areas are Allegheny, Armstrong, Beaver, Butler, Crawford, Erie, Mercer, and Washington, in the west, and Bucks,* Chester, Delaware, Montgomery and Philadelphia in the east, 13 in all. As already stated above under the article on Canada lynx, in some of the northwestern counties the wild cat is actually increasing, especially since the bounty was removed. When we couple this fact with the evidence that in only one-sixth of the entire commonwealth has this highly destructive animal been extirpated, we get some conception of the wilderness condition of a great area in the Keystone state, as well as of the peculiar fitness of the bay lynx to survive and thrive under the altered conditions here imposed by man in the last hundred years.

Records in N. J.—Northern part.—"Very rare and probably will be wholly extinct in a year or two. In Mercer, Middlesex, Essex, Hunterdon, etc., they have been for some years extinct, and it is merely a matter of speculation as to whether or not they are found about the Blue Mountains [Warren and

* The last specimen in these Cos. of which I find record is one shot in Bucks Co. near the Montgomery Co. line in February, 1860 (Rockhill township).—See Buck, Hist. Montgom. Co., 1884, p. 436.

Sussex Cos.] and that portion of the state."—Abbott, Geol. N. J., 1868, p. 753.

Southern part.—"In the southern counties, among the still undisturbed swamps, there are yet, no doubt, perhaps two or three living."—Abbott, *ibid.*

Cape May Co.—"Rare."—Beesley, Geol. Surv. N. J., 1757, appx.

Mercer Co.—"Three killed in Bear Swamp, near Lawrence station, in the last 12 years. One of these is in the Princeton University Museum. I saw one some time between 1850 and '60 [1852] on the Delaware River meadows between Trenton and Bordentown. It may have come down by the river freshets."—Abbott, 1900. "In 1852 a specimen came down the Delaware during a high freshet—was taken near Trenton, and although apparently dead when found, it revived. This may have come from the northern part of the state, but it is by no means certain."—Abbott. Geol. N. J., 1868, p. 753. "One was killed in Bear Swamp 1 mile from Clarksville about 1889 or '91 on J. Yard's farm by J. Yard. It was shot in the early part of the fall gunning season, running before the hounds."—McGuigan. "A fellow named J. Toe, 16 years old, killed one in Ewen township in the Bear Swamp in 1872."—Ray. "The wild cat you were speaking of was shot in November, 1891, by a man named Yard. We have no part of the animal in Princeton Museum. It seems that this cat was sold to some students, who had it stuffed. Another wild cat was shot near Clarksville in October, 1892, by John French."—Silvester, 1901. "In November, 1885, there was a very large specimen shot in the swamp three miles from Princeton (some of the skeleton is in the museum here). There was another individual seen and shot at about the same time but was not killed, nor seen since."—Phillips, 1901.

Ocean Co.—"Several persons at different times heard cries of an animal believed to be a wild cat in the winter of 1897, below Tuckerton, near the shore."—Price and Jillson. "Some young wild cats were said to have been found in a hollow tree in Manahawkin Swamp when the Tuckerton Railroad was being built through said swamp [about 1870]."—Pharo.

Passaic and Sussex Cos.—Not yet exterminated but very rarely taken.—Rhoads, Proc. Acad. N. Sci., Phila., 1897, p. 32. "One occasionally killed in Passaic Co. Last one about 1890."—Nelson, 1900.

Warren Co.—"Six wild cats have been killed during the past five years within four miles of Blairstown."—Davison, 1902.

Habits, description of species, etc.—See above under *Lynx Canadensis*, Canada Lynx.

Family CANIDAE: Wolves, Foxes, Dogs.

Genus *Urocyon* Baird, Mammals of North America, 1857, p. 121.

Northeastern Gray Fox. *Urocyon cinereoargenteus* (Schreber).

1775. *Canis cinereoargenteus* Schreber, Saugthiere, vol. 3, plate 92.
1894. *Urocyon cinereoargenteus* Rhoads, American Naturalist, vol. 28, p. 524.

Type locality.—Eastern North America.

Faunal distribution.—Transition and austral zones; Atlantic Ocean to Lake Michigan and the Great Plains.

Distribution in Pa. and N. J.—Since the deforesting of the Canadian zone in Pa. no county, nor perhaps any territory of considerable extent in either state, is a stranger to it. It was formerly almost unknown in many parts of the higher northern Alleghanies of Pa. It is generally more abundant in the lowlands, decreasing, or giving place to the red fox, in the highlands.

Records in Pa.—Summarizing the reports made from all parts of the state to Dr. Warren and myself, the present status of the gray fox in Pa. may thus be stated: None seem to be found in Chester, Delaware and Montgomery Cos. or in Washington Co., in localities where they would naturally be looked for. The red fox is the only kind found in these counties. It is possible that these unnatural conditions are due to the efforts of fox hunting clubs, which detest the gray fox and encourage the propagation of the red species. In the northern counties where the climatic conditions are most Canadian the gray fox constitutes only five to ten per cent. of the whole number on which bounties were formerly paid. In Adams, Cumberland, Dauphin, Lancaster, and other counties, lying on the eastern slopes of the Blue Ridge and South Mountain, the grays begin to predominate. Both red and gray foxes were noted as being found by Taylor in Lycoming, Tioga and Sullivan Cos. in 1834, when that country was almost unbroken wilderness.

Records in N. J.—The gray is the predominant form in the greater part of N. J., being very abundant in certain sections of the southern half. In the northern counties the reds and grays are about equal in numbers.

Habits, etc.—The differing characters of the two species of fox found in our limits may be expressed in the words used by Dr. Warren: "The red fox is a sly, bold robber, but the gray fox is a cowardly, skulking sneak thief." The two have their counterparts in the timber and prairie wolves. When hounded the gray does not run long distances, but seeks a thick cover and dodges about it like a rabbit, soon taking to a tree or hole in the rocks. In climbing, it shows strange affinity to the cats, not only leaping from limb to

limb in pursuit of prey, but ascending quite tall and limbless trunks by a regular clawing and hugging process, literally "shinning it." They have been surprised in the top of a tree, curled up in the abandoned nest of a hawk. To escape the hounds it sometimes leaps on a reclining tree trunk, runs along some of the more distant branches and leaps as far as it can away from the point of attack to break the scent, or it will hide in the forks of a big tree so deftly as to sometimes nearly escape observation.

The food of both species of eastern fox forms an important consideration in their relations to man. The concurrent opinion of nine-tenths of the farmers and sportsmen of Pa. who contributed to Dr. Warren's economic report on these animals heartily condemn both species as vermin in the worst sense. With this opinion I fully concur. The only argument brought up in their favor is their destruction of mice, moles and insects. As I have previously pointed out in treating the *Muridæ* and as I shall explain later in regard to the *Insectivora*, the destruction of mice and moles is not necessarily a benefit to man, the majority of the former not being proved to be noxious, especially the woodland species which foxes principally devour. Owing to their subterranean habits, the pine mouse, a truly noxious rodent, is rarely captured, the wood vole (*Evotomys*), meadow vole (*Microtus*) and deer mouse (*Peromyscus*) being the species forming the bulk of their mouse diet. Their destruction of insects, especially grasshoppers, is no doubt beneficial but seems to be only fortuitous, one turkey or chicken probably eating as many of these in a day as all the foxes of a square mile in the same length of time. When the fox comes along, as he is ever doing, and eats the turkey, methinks his value as an insect-destroyer suddenly vanishes.

The following wild animals are also preyed on by both species of foxes: fawns, rabbits, squirrels, woodchucks, opossums, skunks, porcupine, muskrats, weasels, all kinds of game birds, any kind of small bird and the eggs and young of all species. Of domestic animals, young lambs, pigs and poultry form no small share of their diet. They also eat a large variety of wild fruits and nuts and have been known to eat corn.

In summing up his observations and data Dr. Warren says: "Foxes do unquestionably more harm than good. The great destruction of wild birds is, I believe, of more loss to agricultural interests than the benefit such interests receive from foxes catching destructive mammals, grasshoppers and other forms of insect life. Foxes not only destroy all kinds of song and insect-eating birds and eggs they can get but they consume game of all kinds—and many game birds at certain seasons of the year eat harmful insects. Advices from different parts of our state, especially in some western counties, show that foxes kill a great many young lambs and sometimes destroy whole litters of pigs; this means a loss of money which in the aggregate is considerable every year. There is little doubt they destroy annually many thousands of

'dollars' worth of poultry in Pennsylvania. Gray foxes do less injury to poultry interests because there are less of them in our state, and, as a rule, they seem to prefer to stay in woods and thickets, away from the habitations of man. The gray fox seems to want to keep away from man's improved possessions, his evil work consisting mainly in destroying beneficial birds and game." In short—" *Good* foxes are *dead* foxes !"

Description of species.—Rather smaller and shorter-legged than red fox. Not subject to mealanism (black phase) as in the red species. Back a coarse grizzle of black and white; belly tawny; cheeks and throat whitish; ears, sides of neck and legs reddish-yellow; a black line along upper side of tail.

Measurements.—Total length, 900 mm. (35½ in.); tail vertebræ, 260 (10¼); hind foot, 125 (5).

Genus *Vulpes* Richardson, Fauna Boreali Americana, 1829, vol. 1, p. 83.

Southeastern Red Fox. *Vulpes fulvus* (Desmarest).

1820. *Canis fulvus* Desmarest, Mammalogie, vol. 1, p. 203.

1842. *Vulpes fulvus* De Kay, Zoölogy of New York, Mammalia, p. 44.

Type locality.—Virginia.

Faunal distribution.—Canadian, transition and upper austral zones, southern Maine to Minnesota (Great Plains), south in mountains to N. Carolina, and in lowlands encroaching into western Tennessee and eastern Virginia; merging in Nova Scotia into *V. fulvus rubricosa* (Bangs) of which *V. rubricosa bangsi* of Merriam, from Labrador (based on a young female !) appears to be a synonym, and *V. deletrix* Bangs of Newfoundland would form another subspecies, did not the arbitrary law of insular isolation overbalance the physiological law of conspecific affinity. These rulings, of course, are subject to the query discussed beyond, of the origin of Desmarest's type of *fulvus*.

Distribution in Pa. and N. J.—Nowhere wholly absent; abundant in the Canadian and transition zones; locally rare in the upper austral of southern N. J. In earlier colonial times unknown in the austral zone, its primitive distribution being greatly altered by its introduction into austral habitat by fox-hunting man and by the altered environment of our lowlands. Owing to the importation of European red foxes into this country in early colonial times, our east American red fox is probably a mongrel species to that extent, claiming as we do that there was originally a specific difference between the two.

Records in Pa.—Consult remarks under this heading in article above on gray fox. Kalm in his "Travels," vol. 1, 1770, p. 283, says "the Red Foxes are very scarce here [Pa. & N. J.]: they are entirely the same with the

European sort." He further states that Bartram, of Philadelphia, told him the Indians were unanimous in saying the red fox was never in the country before the Europeans. In a discussion of the identity of the American and European red foxes in Doughty's Cabinet of Natural History, 1830, vol. 1, pp. 28, 29, there occurs the following significant allusion to the former absence of the red fox in Perry Co., Pa.: "In 1787 when quite a boy I was at the death of the first Red Fox killed in Perry Co., Pa. Not a person present, nor any who saw it for some days, had ever seen or heard of an animal of the kind. At last it was shown to a Mr. Lenarton, an old Jerseyman, who pronounced it an English fox. He said the red fox was imported into New York from England by one of the first English governors, who was said to be a great sportsman, and turned out on Long Island, where they remained for many years but at last made their way on the ice to the mainland and spread over the country."—See American Turf Register and Sporting Magazine, vol. 1, p. 74. Such statements as the above should be considered by present-day investigators. The following from Audubon and Bachman is confirmatory of the fact that a large part of the mountainous country inhabited by the red fox in 1850 was destitute of them a hundred years previously: "In the early history of our country the red fox was unknown south of Pennsylvania, that state being its southern limit. In process of time it was found in the mountains of Virginia, where it has now become more abundant than the gray fox."—Quad. N. Amer., vol. 2, p. 270. In view of these statements and of the fact that European foxes had been introduced into New England, Pennsylvania and Virginia for sporting purposes by the middle of the 18th century (1750), it looks quite likely that the red foxes mentioned by Kalm as being found in N. J. and Pa. in 1770, also the one found in Perry Co. in 1789 and those described by Desmarest* as coming from "Virginia" in 1820 were pure descendants of the European red fox. In such a case *Vulpes fulvus* of course is a synonym of *Vulpes vulpes* (Linnæus). Where then was the American red fox in pre-Columbian times? If it was not in Perry Co. in 1789, nor in the mountains of Virginla till a much later date, it must have been somewhere in the region north of the Great Lakes or in the Hudson Bay regions, where the Delaware Valley Indians, who talked to Bartram, could not come in contact with it. This was probably the case, and in these regions only are we to seek for specimens to establish the real differences between the two continental forms. No doubt the difficulty of determining the

* Based on the *Renard de Virginie* of Palisot de Beauvois, Bulletin de las Societe Philomathique, 1800, p. 137. Curiously enough the tenability of *V. fulvus* Desmarest is further weakened by its only reference, viz, to Beauvois just cited. Beauvois' description is solely based on the *skull of a gray fox* which he compares with that of the European red fox, thinking he had in hand the skull of an American red fox. Desmarest's description of external characters was based on a red fox skin, locality not stated.

status of the two in the past has been due to the use by naturalists of specimens more or less thoroughly European in their ancestry. Prof. S. F. Baird establishes the almost certain non-existence of the red fox in eastern Pennsylvania during comparatively recent times by the following statements which are so pertinent to this matter that I quote them: "It is not a little remarkable that there have as yet been no remains of the red fox detected among the [post pliocene and more recent] fossils derived from the Carlisle and other bone caves. The gray fox is abundantly represented, but not a trace of the other. This would almost give color to the impression, somewhat prevalent, that the red fox of eastern America is the descendant of individuals of the European red fox imported many years ago, and allowed to run wild and overspread the country. The fact of their present abundance and extent of distribution is no barrier to the reception of this idea, as the same has been the case with horses brought over by the Spaniards after the discovery of America, and set at liberty."—Mam. N. Amer., 1857, p. 130. It is also significant that a general N. J. law, fixing bounties on wolves, was in 1714 extended to include "*Red* Foxes," indicating that they had not begun to be troublesome until that date. So far as the above statements go, with many others of like import, it may be asserted as an indisputable fact that no satisfactory comparison was ever made and published which had for its subjects a series of European and Virginian, or Pennsylvanian red foxes with skins, skulls and data prepared according to modern standards. Such a comparison would be an interesting and valuable contribution to mammalogy and might reveal some significant facts.

Records in N. J.—Cape May Co.—"Seldom taken."—Beesley, Geol. Surv. N. J., 1857 Appx. "One caught near Dennisville by Chas. Crandole about 1875."—Lee. Edward Harris, of Moorestown, N. J., the friend of Audubon, wrote him regarding the method of hunting red foxes at Beesley's Point in December, 1845. The foxes were located on Peck's beach, undoubtedly placed there for the purpose by the hunters. They used no dogs, but had drivers with clap-boards and rattles to make a din. Beesley told Harris he had known 7 red foxes to be cornered thus at the point of the beach. The gray fox was not found on the beach. Audubon's plate of the red fox was taken from one of these Peck's beach specimens sent him by Harris. It may now be considered one of the most typical representations of the descendants of imported *Vulpes vulpes*. See Aud. and Bach., Quad. N. Amer., 1851, vol. 2, pp. 265, 266, 267.

Hudson Co.—"On the height beyond Weehawken in the Jerseys a good many red foxes are to be found, as well as more gray ones."—*Ibid.*, p. 268.

Mercer Co.—"Formerly was very abundant throughout the state, but now [1868] is very rarely met with. The last specimen seen in Mercer Co. was in 1850, and it is doubtful if others are now living in that or the adjoining

counties. The northern and extreme southern sections of the state are the favored localities."—Abbott, Geol. N. J., appx. p. 753. "Have known of two individuals shot on Mt. Lucas, one in 1879, the other about 1890."—Silvester, 1901.

Undoubtedly the red fox is nowhere common in N. J. as in Pa., though numerous in the more rocky, mountainous districts. It is very rare in the pine barrens, those in Cape May Co. probably being the decimated descendants of those introduced long ago on Peck's beach and similar situations along shore where they were confined by the intervening waters of the bay. As these were sometimes frozen over in severe winters, some of these foxes would cross to the mainland and become scattered.

Habits, etc.—See above, under gray fox.

Description of species.—Upper head, body and tail, bright, clear, yellowish rufous; belly, chin, throat and breast whitish. Legs brownish rufous, darkening to the feet; tail tipped with white. Black and silver and cross foxes are only melanotic phases of this species. As in the gray squirrel and wolf of the same regions these color-phases seem more numerous northward. All phases of color may be found in the same litter, one or both or neither of the parents being so colored. A Samson fox is merely one whose pelage has become worn, thin, curly or crisp, generally from a disease which prevents, interrupts or otherwise affects the molt. It indicates a run-down or depauperate condition, or may sometimes result from being caught in forest fires. Warren records three living black or silver foxes in Pa. known to him, one in Clinton Co., one near Lake Genoga, Sullivan Co., and a third in Pike Co. Mr. E. O. Austin, of Austin, Potter Co., writes me that he saw the skin of one in Coudersport many years ago. He also saw one running off when he was a boy. The cross fox and silver fox he pronounces rare in Potter Co. The black fox alluded to was sold for $200 by P. A. Stebbins, of Coudersport, a cross fox at the same time bringing $80. Mr. Lin. Parker says that a strange, blackish animal with long hair and bushy tail was seen near Highland Lake two years ago. This may have been the Ganoga Lake black fox mentioned by Warren. Audubon states that black foxes were "occasionally, but very rarely, killed in the mountainous parts of Pennsylvania" in his day, 1850.

Measurements.—Total length, 1000 mm. (39½ in.); tail vertebræ, 360 (14); hind foot, 150 (5¾).

Genus *Canis* Linnæus, Systema Naturæ, 1758, vol. 1, p. 38.

Appalachian Gray Wolf; Timber Wolf. *Canis mexicanus nubilus* (Say).

1823. *Canis nubilus* (Say), Long's Expedition to the Rocky Mountains, vol. 1, p. 169.

1894. *Canis mexicanus nubilus* Rhoads, American Naturalist, vol. 28, p. 524.

Type locality.—Vicinity of Council Bluffs, Pottawatamie Co., Iowa.

Faunal distribution.—Nothing can be now defined as to the faunal relations of the North American gray wolves. The name above given was applied to a wolf nearer than any yet named, geographically and faunally, to the eastern animal, but as it belongs to a prairie-haunting wolf it may not be applicable to our timber wolf in a subspecific sense. I adopt it as the most tenable name for our wolf yet published, there seeming to be no old names specially applicable to wolves found east of the Mississippi River and north of Georgia. Perhaps *occidentalis* of Richardson may be as applicable.

Distribution in Pa. and N. J.—Wolves were once commonly and uniformly distributed over the entire limits of the two states. They were apparently exterminated in Pa. within the last 10 or 15 years, but more recent accounts seem to indicate that a remnant of the typical Alleghanian animal may still exist in the mountains separating Westmoreland and Somerset Cos., Pa. In N. J. they had been exterminated so early, even in the northern wilds, that I can get no data as to the last survivors. They were approximately exterminated in N. J. in the early decades of the 19th century. As one was killed in Wayne Co. in 1887, being driven in from New York state by dogs, it is quite likely that a stray wanderer may have come from the same sources into the Sussex Co. mountains as late as the middle of the century, from New York or Pa.

Records in Pa.—General records.—"The following notes seem to indicate that the wolf has never been wholly exterminated in Pennsylvania, but that there yet exist some of these wary rovers of the wilderness, to attest the theory that no country where the Virginia deer yet remain is free from their incursions. It is well known that the wolf is frequently noted in the Alleghany mountains of West Virginia, and the nature of the country lying between these and the wilds of western Pennsylvania so favors communication between the two that it requires no stretch of fancy to understand how the crafty wanderers yet defy extermination."—Rhoads, Proc. A. N. Sci., Phila., 1897, pp. 220, 221. "In view of the fact that for several years past the writer has made especial efforts to verify the statement that this animal is still to be found in Pennsylvania, and has failed, he is very much inclined to the opinion that none of the species in a wild state are present in this Commonwealth. It is true that bounty records in different counties of the state, as late, perhaps, as six months since, show that wolf scalps have been paid for. Such data, however, must not be taken as conclusive evidence of the presence of these animals, for the heads and ears of grizzly, long-haired cur dogs, etc., or the pelts of wolves brought to Pennsylvania from other states, have in past years proven of considerable value to scalp hunters, although expensive to the local taxpayers."—Warren, Poultry Book, 1896, p. 495.

Bradford Co.—"I purchased a pair of unbroken colts in the fall of 1877 and put them to work at once. They were still quite wild when a wolf crossed the road in front of them as I was returning from Fox Centre, Sullivan Co., to Canton, Bradford Co."—Cleveland.

Bucks Co.—A wolf was captured in Bucks Co. by John Smith about 1800. —Mercer, "Tools of the Nation Maker," 1897.

Cameron Co.—"Practically exterminated; one hunter saw wolf tracks a year ago."—Larrabee, 1896. "I was told by 3 men that that they saw 2 wolves catch and kill a deer in Wyckof Run [Gibson Township] alongside of the lumber railroad."—Nelson. No date of this occurrence was given, but it was furnished among some notes of recent records.—Rhoads, Proc. A. N. Sci., Phila., 1897, p. 221.

Chester Co.—January 1st, 1816, a wolf was killed at West Nottingham.—Watson's Annals, 1830.

Clearfield Co.—"The last wolf was killed in Clearfield Co. with a club by a man on horseback, the winter of 1891–'92. It was killed by William Bonsall of the same county."—Nelson; see Rhoads, P. A. N. S., 1897, p. 221. "The last [Pa.] wolf I have knowledge of was killed by myself in 1858, near Janesville. The circumstances were as follows: Mr. Joseph McCully and wife were on their way to the grist mill near Janesville; a colt was following the sled and a wolf came in pursuit. It followed within a mile of the settlement. Mr. McCully aroused me in the early morning and related the facts in the case, and I took the track of the animal and in a few hours shot him." —Abraham Neveling in Warren's Poultry Book, p. 498.

Clinton Co.—"I have been told by 2 hunters that they saw 2 wolves this winter about 6 miles from my place [Round Island, 1893–94], but I have been all through that woods and see no signs of anything but lynx, wild cats and foxes."—Nelson in Proc. Acad. N. Sci., Phila., 1897, p. 221.

Elk Co.—"Few, if any, left in Elk Co. None captured in the last decade."—Luhr, 1900. "Last wolf was shot in Elk Co. in 1891."—Clay. "A wolf was killed in Elk Co. by a deer hunter about the year 1887."—Stevens.

Forest Co.—The last known to me was killed in a big windfall on Hemlock Creek about 1855, but S. M. Henry, county treasurer, says the last one killed in the county was taken by Emanuel Dobson in Jenks township in 1884."—Irwin. "A few lived in Forest Co. from 1850 to 1856."—Haslet.

Franklin Co.—To illustrate the kind of wolf stories invented in Pa. and evidence produced to verify them and secure bounty for scalps, the notorious instance of Joe Poole's "wolf" may be briefly given. My correspondent, Mr. Strealy of Chambersburg, sent me the first newspaper accounts of this capture, in which Poole, of North Mountain, an old, well-known trapper in the Chambersburg region, produced the skin of a wolf which he declared he trapped in Bear Valley, near Loudon, Peters township, in March, 1897. So

cunningly did Poole play his game that many hunters who visited him, skeptical of the truth of his story, went away convinced he had the genuine article. Among these Mr. Strealy and some of his hunting friends did some careful detective work, and were about converted to Poole's logic. A photograph of Poole, with the wolf skin in his lap, was taken and sent to me. Meanwhile I believe the bounty was paid to Poole by the county treasurer. Poole consented finally to sell the skin and to produce the skull of the animal as further evidence of his sincerity and uprightness. I purchased these, and they were forwarded to the Academy of Natural Sciences by Mr. Strealy. An examination of the skin showed conclusively that it was from a coyote or prairie wolf, and from the manner of tanning and method of skinning, resembled closely a poor specimen of the skins of these animals shipped from the west to our eastern markets for rugs. The skull sent was that of an old dog, resembling closely the skull of a fox-hound. Poole had stated that he killed the animal in his trap by a blow on the head with an axe or hatchet. To give color to this he had slit the skin of the face with a knife, and pushed one of the nasal bones of the skull down into the nasal cavity. That both of these mutilations had been made after the tanning of the skin and the maceration of the skull was plainly evident. These specimens of "Pennsylvania wolf" will be preserved, as an object lesson to future investigators of the Pa. fauna, in the collections of the Academy of Natural Sciences of Philadelphia. —Rhoads.

Lackawanna Co.—"The Lackawanna Co. records show that 4 wolves were paid for in 1896. Dr. Isaiah F. Everhart and Mr. Geo. P. Friant, of Scranton, are inclined to believe there is some mistake about these animals, as neither has heard of a genuine wild wolf in that locality within the last 20 years."—Warren, Poultry Book, 1897.

Lancaster Co.—See York Co.

Luzerne Co.—"About the year 1845 wolves were abundant in Tomhickon Valley, between Catawissa and Hazleton, where, according to my friend Dr. Thomas C. Thornton, they often attacked human beings, destroyed the settlers' cattle, sheep and poultry and devoured game." Warren, Poultry Book, p. 498. Warren continues to relate how the father of Dr. Thornton, also a doctor, becoming lost in this region on his way to visit a patient, was beset by wolves but fortunately defeated them after a two-day skirmish by the use of ammonia, with which he saturated one of his leggings and struck the animals as they came near, the mysterious character of his defense getting the better of their rapacity more on account of its invisible nature than its physical effects. No doubt the defense of a skunk is efficacious partly on the same grounds. From 1808 to 1820 Luzerne Co. paid $2872 in $5 bounties for wolf scalps. As many as 273 wolves were killed in 1 year. "George Crockett occasionally brings the scalp of a wolf to Wilkesbarre [in 1860] for which the county treasurer pays him $25."—Annals Luz. Co., Pearce, 1860, p. 495.

McKean Co.—"The last one killed in the county was about 14 years ago." —W. C. Dickeson, 1899. "From the 18th of May, 1869, to May 15th, 1872, I caught 15 wolves and crippled 3 more. I think I have seen where wolves have killed 150 sheep at least. I have seen where wolves have killed deer a good many times. The last gray wolf killed in this county was taken by a boy on the Kinzua Creek in 1886."—C. W. Dickinson in Warren's Poultry book, p. 497. "This county used to pay a bounty on wolves; $25.00 on a grown wolf and $12.00 on each whelp. In June, 1868, two men, Leroy Lyman, of Potter Co., and J. W. Stark, of Smethport, found a den or nest of young wolves on Cole Creek, this Co. They got three whelps and later the mother of them. On the 18th day of May, 1869, I found a nest of wolves on the south fork of the west branch of Potato Creek. I got five young ones and three weeks later caught both of the old ones. In October, 1870, I caught another one. In Sept., 1871, I caught one; also in Oct., 1872, got one, and May, 1872, I found a nest where I got seven whelps and caught an old one, but he left a hind foot in my trap and made good his escape. This wolf was the last wolf killed in this county, viz., in 1886 [killed by the boys, later]."—C. W. Dickinson, 1901. In a later letter Mr. Dickinson explains that this same wolf, whose foot was left in his trap, was killed by a stone thrown by one of two boys who found it in their rambles on Kinzua Creek, exact locality not stated. The boys were from Bradford, McKean Co.—Rhoads.

Mifflin Co.—"In relation to wolves in Mifflin Co., Pa., it was stated by one of our hunting party that the beds of thirteen wolves had been seen that fall [1898] by some lumbermen. I gave no credence to the report, and probably would not have thought of it again had I not seen a statement in a newspaper giving an account of wolves attacking a school teacher in one of the adjoining counties."—Cleveland.

Monroe and Pike Cos.—"I can get no information as to the date of the disappearance of the timber wolf from this part of the state. Conservative residents set it as nearly 40 years ago, but it is probable they existed to a much later date."—Rhoads, 1894. See in this relation Wayne Co. records. —Rhoads, 1902.

Potter Co.—"Practically extinct. I saw many as late as 1857 on the headwaters of Pine Creek and the Sinnemahoning. The last I knew killed here was taken by Leroy Lyman about 1875."—Austin, 1900. The county records for 1890 show that a wolf was paid for in Potter Co. that year by the Co. Treasurer.—See Warren's Poultry Book, p. 690.

Somerset and Westmoreland Cos.—While stationed at Laughlintown, Westm. Co., collecting specimens for the Carnegie museum of Pittsburg in 1898, I was informed by several persons that wolves made their home in Laurel Ridge, the part of the main range of the Alleghanies separating

Somerset and Westmoreland Cos. It was stated that two or three had been captured or wounded in the last few years in these mountains, and that their tracks had been seen every winter in the snow, indicating there were several of them. Since that time many newspaper accounts have been published yearly as to their being seen or chased by hunters in that region. My faithful correspondent, Dr. H. D. Moore, of New Lexington, Somerset Co., has sent me some notice of these incidents, but was unable to vouch for them. A dispatch to the Phila. North American, dated Feb. 28, 1901, kept these rumors booming by a sanguinary account of how 'three gaunt wolves, driven from the mountains by hunger, descended upon the town of Rockwood, Somerset Co., and attacked a team of horses standing in front of Miller's general store." The hotel proprietor brained one; another was shot; the third escaped. This story has not been followed up by me. Dr. Moore has not yet corroborated it. Meanwhile, I have received the following from Mr. W. E. McHenry, of Johnstown, Cambria Co.: "Our attorney, Mr. H. S. Endsley, informs me that about two years ago [1897] a hunter named Aneer, shot a gray wolf in Jefferson township, Somerset Co." Under date of February 6th, 1902, Dr. Moore sends me the following clipping from a Pittsburg paper: "Wolves from the mountain district in Westmoreland county are playing havock with live stock. Near [Laughlintown] Vestry Eagan, a farmer set a trap Sunday night and caught a gray wolf of unusual size." Dr. Moore writes that he is investigating the matter and that "Laughlintown is in a section of the mountain where a Somerset Co. man claims to have trapped a wolf two years ago." Since Moore's letter a letter has been received from an acquaintance living in Laughlintown, Mrs. Gertrude Fry, stating: "Some men at the lumber camp in the mountains have captured a live wolf and are keeping it in the camp."—Dated Feb. 10th, 1902. In his Poultry book, p. 495, Dr. Warren says: "A large wolf was lately slain in Westmoreland Co., but investigation showed it had been shipped alive from the far west and liberated to be pursued by hounds, from which it escaped, to be subsequently taken as a genuine example of a Pennsylvania wolf." Is this the Aneer wolf? I have since received, through Mr. Todd, Dr. Moore and Mrs. Fry, letters which show that the recent "Vestry Eagan" (Aiken) wolf was a myth and the story a deliberate lie. The Aneer wolf, through Mr. Todd's investigation, has reached the following stage of inquiry: "John Aneer, aged 86, killed a wolf Feb. 5th, 1897; very ferocious; shot him in a trap; too heavy to carry; brought it home on a horse; removed the hide; sold it; received $3 for the pelt and $10 premium; it was on exhibition at Hotel Van Near, Somerset [Somerset Co.]; Charles Van Near bought the pelt, had it tanned, making a robe of it. Aneer has seen no wolf tracks this winter.' These facts were communicated to Mr. Todd by a Mr. Queer, grandson of Aneer, and by John L. Boyd, of Ligonier, Pa. In a letter dated

Somerset, Pa., Hotel Van Near, April 10, 1902, we find C. S. Van Near's statements regarding the wolf in question. It will be seen that John "*Aneer*," above quoted, should be John *Queer*, and that there seems no doubt of the capture of the animal. Its origin, as suggested by Dr. Warren, is doubtful. The letter is as follows: "Mr. Samuel N. Rhoads, Dear Sir: Your letter of inquiry received in regard to wolf hide which I have. In reply would say that he was a very large gray timber wolf, and was caught in a trap in Laurel Hill Mountains by an old man by the name of John Queer. He measured six (6) feet and two (2) inches from point of his nose to tip of tail without any stretching. His height at shoulders was three (3) feet and at hips two (2) feet and eight (8) inches. His front legs very strong and about the size of a man's arm. Mr. Queer brought him here to Somerset, Pa., and got ten (10) dol. bounty for him from the commissioners and I bought the hide and gave him three (3) dol. for it, and I tried to get it mounted but was unable, and had it tanned and have it yet. His color: the under side of his body is rather light, his legs are a little brown and gray, his sides are gray, and along back and tail are gray mixed with black and mostly black. If you wish to see the hide you can see it any time here at Hotel Arlington, Somerset, Pa. Very truly yours, C. S. Van Near."

Sullivan Co.—"The last wolf killed here was in 1860, by Richard Williams."—Behr., 1902. "Long since exterminated."—Bennett, 1896.

Tioga Co.—The county bounty records for 1896 show that $30 was collected by Chas. Kerby for the killing of 3 wolves in Tioga. The newspaper clipping which follows was sent me by a correspondent. It indicated not so much the abundance of Pa. wolves as the scarcity of that love for truth which so many people lose in their greed for filthy lucre: "Wellsboro, Pa., Jan. 24, 1897.—By the confession of one of the persons implicated, the particulars of a unique story have just come to light in the lower end of this county. Last fall, when Charles Lee's circus returned to Canton to go into winter quarters, the sheriff sold him out. Among the animals in the menageries were three prairie wolves, which were sold for 50 cents each to Charles Kerby, of Cedar Lodge. He kept them chained in his dooryard until cold weather set in, when a bright thought struck him. With the aid of two men from Canton the beasts were put in a box and hauled into a forest away back in Liberty township, where they were shot. Although wolves have been extinct in Pennsylvania for many years, there is an old law giving $10 bounty for wolf scalps. Kerby took the three pelts to the office of Justice of the Peace De Coursey, where he made affidavit that he killed them within the bailiwick of Tioga, got the $30 bounty and went home happy." See also Dr. Warren's remarks on this fiasco, p. 496 of the Poultry Book. "About 1885 Levi Kissinger, of Roaring Branch, killed a wolf."—Cleveland. A fuller account was later sent to me by Dr. Cleveland as follows: "Mr. Levi Kissinger, of

Liberty, writes: 'In reply to your letter, I would say I killed that wolf, as near as I could tell, in the fall of 1874, during one of the first tracking snows. The wolf had killed, in the neighborhood of Jackson township, about 50 or 60 sheep before I shot him on Laurel Hill, between Tim Gray's and Red Ross's. I received no bounty; they told me there was none. The skin I gave to preacher King, for two dollars on his salary. The wolf was killed before I moved from Union in 1875.' W. C. Sechrist, Esq., of Canton, Pa., a descendant of the Sechrists of Liberty, says that he opened an office in Canton in 1881, that Kissinger brought the wolf skin to his office after that date, and is positive that Mr. Kissinger is mistaken in his date. I got the date 1885 from John Sechrist, of Blossburg, Pa., who was living a near neighbor to Mr. Kissinger when he killed the wolf."—Cleveland, 1901.

Wayne Co.—"The last wolf was taken by Wm. T. Teeple in north central part of Lebanon township in 1848."—Kellew or Goodnough. "The last one killed in this Co. was by Phineas Teeple more than 40 years ago."—Teeple and Day, 1899. "A wolf was killed at Prompton, central Wayne Co., near Honesdale in 1887, by Daniel Routan. It was run in from N. York State by a hound."—Stevens. See Rhoads, Proc. Acad. N. Sci., Phila., 1897, p. 221.

Wyoming Co.—O. B. Vose caught the last one in this Co. about 30 years ago."—Robinson, 1900.

York Co.—"Within ten years a wolf crossed the Susquehanna River from York County" into Lancaster Co.—See Rupp's Hist. Lanc. and York Cos., 1844.

Records in N. J.—In the absence of any records dating even approximately the disappearance of this animal from N. J., I give a few historic references. The reader is referred to my quotations regarding N. J. bounty laws on wolves under the article on the cougar or panther. Mr. F. B. Lee, of Trenton, furnishes the following additional information in this matter. It is taken from the Newark Daily Advertiser of 1843 or 1844: "In June, 1682, a bounty of 15 shillings per head on wolves was offered by each [N. J.] county and 15 shillings additional were paid by the town in whose limits the animals might be killed, excepting the towns in Somerset Co., where seven shillings were paid. In 1693 these laws were repealed and it was left to the discretion of each town to adopt such measures as might be necessary to exterminate the wolves. General legislation however was again resorted to in March, 1714, and the bounty was extended to panthers and red foxes." In July, 1730, a repealer was passed against the red fox bounty, and the sum of 20 shillings was set on the head of every adult wolf, only 5 shillings for a whelp, and for panthers 15 shillings. These bounties being found insufficient were increased in 1751 to 60 shillings for wolves and 10 shillings for whelps. From the manuscript account of my ancestor Ebenezer Hopkins, of Haddonfield, county collector and treasurer of Gloucester Co., N. J., in the years

1753, 1749 and '50, some idea of the number of wolves and panthers in that then extensive county may be gathered. I give the names and dates merely: "John Boston, Junior, 3 mo., 10, 1753, 2 wolf heads, 6 pounds sterling; Gideon Scull, 3 mo., 15, 1753, panther's head, 15 shillings; George May, 12 mo., 3, 1749, wolf's head, 1 pound; Indian Sam, 12 mo., 6, 1749, panther's head; Indian Oliver, 4 mo., 4. 1850, wolf's head, 1 pound; Richard Fry, 6 mo., 9, 1850, panther head, 15 shillings." Nearly half of the whole number of entries of payments by E. Hopkins are of bounties on wild beasts. Kalm states that at the time the small pox nearly exterminated the Indians in N. J. and Pa. the wolves became very abundant and bold around their villages, and that they were still abundant up country in 1770 in the two states. The inhabitants of the N. J. seacoast used to capture wolves in pits. Such places, used by his ancestors on the farm of Albert Pharo, Tuckerton, N. J., were shown to me in 1891 by the owner, who stated they were used for that purpose in his father's early days. I am told by Dr. T. P. Price, of Tuckerton, that similar pits are to be seen on the Phineas Burton farm farther down shore.

Habits, etc.—Literature, folk-lore, legend and tradition are so profuse respecting the cunning, wisdom, ferocity, cowardice and boldness of this animal, I can add nothing to it. E. S. Thompson's classic chapters on the animal, recently published, apply as directly to the wolves of the east as to those of the west.

Description of species.—No specimens of a Pa. or N. J. wolf, not even a skin or a skull, being known to me, I cannot define their characters. Black and white wolves are not mentioned as being found in the state that I remember, the gray being typical in our limits. In Godman's American Natural History, vol. 1, 1826, p. 260, he says: "The wolf found in Pennsylvania is of a reddish-brown color, the hair being tipped with black, but especially so over the fore-shoulders and sides." It is hoped that any persons knowing of the existence of any of the recent remains of our Pa. and N. J. wolf, whether fur, robe, mounted skin or skull, will forward them for preservation in one of our state museums ere all evidence of their characters be lost. The same remarks apply to the Pa. and N. J. panther, lynx, fisher, beaver, fox squirrel and the N. J. deer.

Family MUSTELIDÆ; Otters, weasels, skunks, etc.

Genus *Lutra* Erxleben, Systema Regni Anim., 1777, vol. 1, p. 445.

Northeastern Otter. *Lutra canadensis* (Schreber).

1776. *Mustela lutra canadensis* Schreber, Saugthiere, pl. 126 B.

1823. *Lutra canadensis* Sabine, Franklin's Narrative, Journal to Polar Sea, p. 653.

Type locality.—Eastern Canada.

Faunal distribution.—Hudsonian, Canadian and transition zones; Hudson Bay and Atlantic Ocean to the Cascade Mountains.

Distribution in Pa. and N. J.—The more typical Canadian form of otter may be said to be found only in the water courses and lakes of the higher mountains of the two states, blending as we reach tide-water into the southern form *lataxina*, next considered. At one time evenly and numerously distributed, it has become rare almost everywhere, and in many places is only known as an occasional straggler from more favored localities.

Records in Pa. and N. J.—On consulting my records from about 100 different localities in all parts of the two states it seems superfluous to enumerate them in order. The otter, while supposed to be absent from a great many localities, and never seen even by ordinary hunters and woodsmen, often exists in the most thickly populated districts, escaping observation on account of its aquatic and nocturnal habits and its extreme wariness. Indeed it is now more abundant in the unpolluted tidewater streams of our country in the immediate vicinity of towns and villages than in some of the wilds of the mountains. This is owing to the destruction of fish and the otherwise noxious condition of our streams in many extensive mountain tracts due to the drainage from tanneries, mines, oil wells, chemical works, factories and foundries. In the unpolluted glacial lakes of northern Pa. and N. J. their numbers are greater. The tidewater creeks of Pa. and N. J., both maritime and inland, are never without some of these aquatic rovers. The cedar swamps and inland dams of N. J. form a secure and uncontaminated rendezvous for otters. In Chester, Delaware, Philadelphia and Bucks counties of Pa., and more especially in Cumberland, Salem, Gloucester, Camden, Burlington and Mercer of N. J., the affluents of the Delaware River probably harbor more otters than in any other area of equal size in the two states. Owing to the decline of expert trappers, they are rarely discovered and more seldom captured, though their signs may be discovered along these waters at any time by one conversant with them.

Habits, etc.—Owing to their sociability, aquatic life, extreme agility and playfulness and their simple diet of fish, in whose pursuit they exhibit so much address and amazing skill, without the bloodthirsty and wanton destructiveness of other carnivorous species, the habits of the otter are of especial interest. The principal food of the otter is fish, they being able to chase and capture with comparative ease such nimble species as the trout, salmon and pickerel, the latter species forming a large part of its diet in the lakes of the north and the waters of the N. J. cedar swamps. It also devours more sluggish species in maritime waters, as the sucker, mullet and perch. The cray-

fish, eel, shrimp, fresh-water mussels and probably such tender-shelled bivalves as are found in the bays frequented by them are also eaten. In the water, the grace, swiftness and agility of this animal excite admiration. It can remain a long time beneath the surface, twisting and doubling in the chase, leaping out and diving again as its victim breaks cover, and bringing the prey to the bank when caught to eat it, devouring first the head as the most delicate part. On land this animal is by no means awkward, often traversing miles in the rutting season or in winter in a cross-country search for its comrades or for better hunting grounds. On such occasions it takes a direct course, often crossing hilly and open country to attain its object. When snow is on the ground it alternately leaps and slides along, taking advantage of every slope for a long slide and often diving under the snow for long distances. This method of locomotion is so swift that Richardson says a swift runner on snow-shoes often finds trouble to overtake and capture one. Godman says, "Their favorite sport is sliding, and for this purpose in winter the highest ridge of snow is selected, to the top of which the otters scramble, where, lying on the belly with the fore feet bent backwards, they give themselves an impulse with their hind legs and swiftly glide head foremost down the declivity, sometimes for the distance of twenty yards. This sport they continue apparently with the keenest enjoyment until fatigue or hunger induces them to desist." Snow is not necessary for this enjoyment. They relish a steep mud slide and plunge from a creek or river bank into the depths of a pool at all seasons quite as much. I discovered such a slide on the banks of the Pennsaukin Creek near Lenola, Burlington Co., N. J., a few years ago. This was in the near vicinity of a great otter den to which I will allude later on. The slide was on the face of a blue clay exposure of the upper marl bed, rising directly from the waters of the tide marsh to a height of 40 feet and at an angle of 65 or 70 degrees. The slide began at about 30 feet above the water and descended to it, where now only a small stream represents the main body of the creek which once ran deep and wide against this wall of mud. So steep was this slide, and when wet, and in use, so slippery, it would have been useless for sporting purposes without a diving pool at the bottom. This, no doubt, was its former condition, but the creek having been deflected to the opposite side of the marsh it was used at the time I discovered it only as a path; the otters having been previously driven from their home in that place by the extensive excavations of a brick and terra cotta works in the clay bed.

The otters of the middle and southern states are said by Audubon to have their young in March, the number being from 1 to 3 in a litter. Owing to the high value always maintained in the world's markets for the fur of this animal, it is the more wonderful how it has escaped extinction in common with other fur-bearing American species. Over 11,000 pelts were reported

to have been shipped from Canada by the Hudson Bay Co. alone to London in 1873. Godman says that over 17,000 were sent in one year by the same company in the early part of the 19th century. Their value as a raw fur at present runs as high as $10 or $12 for northern specimens. Regarding the home of our otter, I will quote from an account I published on "New Jersey Otters" in "The Friend," a Philadelphia weekly, under date of February 24, 1894:

"Very few of us have ever seen a live otter, and perhaps the majority believe this animal to have long since become extinct in the settled parts of the Middle States. On the contrary, it is not a rare inhabitant of the wilder parts of New Jersey and Pennsylvania, and is occasionally met with in the larger streams of our more thickly populated districts.

"Its apparent rarity is chiefly due to its nocturnal and aquatic habits and to its extreme wariness, and, as will be shown, this deception is further accomplished by its peculiar domestic economy in the construction of its burrow.

"By this happy combination the otter exists among us to-day, the only large fur-bearing animal fitted to survive in the midst of civilized surroundings such as have long since caused the extermination of its former associates, the panther, wolf and beaver.

"This result cannot be attributed to the greater value of the latter as objects of the chase, for the peltry of a full-grown otter is to-day worth much more than that of a beaver, and nearly thrice that of a wolf.

"Recent inquiries into the habits and distribution of our native mammals have been rewarded by answers from several correspondents in Pennsylvania and New Jersey, and I have been struck with the frequency with which the otter is made the subject of them. The larger number of these advices related to the presence of this animal in New Jersey. Among these was a kind note from the editor of *The Friend*, stating that he had seen a large burrow (said to have been the home of an otter), while hunting fossils in a clay pit on the bank of Pensaukin Creek, near Lenola, New Jersey, and I gladly accepted my friend's invitation to pay the place a visit.

"The site of this burrow was found to lie in the left bank of the creek, just above the bridge on the Camden & Burlington County Railroad. It is about five miles from the Delaware River and near the head of the tide-water marsh. Extensive and deep deposits of brick clay, overlaid with a thin stratum of ferruginous fossil-bearing marl, are here situated. In driving their excavations through this bed, Augustus Reeve, the owner of the works, had removed a wide and deep section of the creek bank, both at right angles and parallel to the course of the stream, leaving a steep section of the face of the bluff intact. Standing in the excavation, my attention was called to two holes high up in the face of this solid clay wall. One of them was about ten feet

below the original surface of the bluff and fifteen feet higher than the creek. Its horizontal diameter at that point was nearly two feet, its vertical diameter somewhat less. It descended, at an angle of 45 degrees, toward the edge of the marsh, but I failed to find an opening, either above or below the water, at the point indicated. The walls of this tunnel were quite smooth at the sides and bottom and arched throughout with wonderful regularity of outline and dimensions, and exposure to the air had so hardened the clay matrix as to give it the appearance of having been chiselled through rock. The other opening lay at about the same level, fifteen feet to the right of the first. It was smaller, more circular, and seemingly represented a branch from the other, appearing to join it at an acute angle, about ten feet from the edge of the marsh. Its diameter was about ten inches, too narrow to allow two large otters to pass by each other. From the appearance of these excavations I was sure they belonged to no animal whose home I had hitherto examined, and after a short search was so fortunate as to find the foreman of the brick works, who had engineered the entire 'diggings.' The first intimation he had of the presence of otters in this locality was the discovery of a large hole in the bottom of the creek, where it now runs through the swamp, seventy yards from its former channel, against the bluff occupied by the burrow. Otters had long been reported as frequenting the creek, but he had never seen them. The occasional loud splashing and growls of an animal (not a muskrat) in that spot, however, confirmed his suspicions that the hole in the creek bottom was still frequented by these wary fishermen. Not long after, as his men were digging through the bluff, they broke into a large chamber, 'big enough to hold a horse and cart.' This was located six feet below the surface and about forty feet from the edge of the bank. It terminated the smaller burrow, previously alluded to as number two.

"Subsequent digging, a year or two later, showed that burrow number one soon diverged far to the right of the point where I had examined it, and terminated, at a depth of twelve or fifteen feet below the top of the bluff, in an oval chamber, much smaller than the other, about six feet long and three feet high. This arm of the Y was much the longer of the two, reaching sixty or seventy feet from its junction with the first. The tunnel leading to it was more than twice the size of that leading to the larger chamber. The man emphatically declared that these dormitories and passage-ways contained no litter, refuse or nesting material, nor any remains of the otter's food, nor did he discover any side-pockets or offsets, in which the animals would have brought forth their young, other than those already described.

"The following summary of the construction of this dormitory or play-house seems the most reasonable that can be offered: It had originally been dug (probably hundreds of years ago) from the bottom of the creek, then running deep against the bluff in which it is located, and had been excavated

at that time to the full extent observed by the workmen. It is possible the large amount of soil thrown out of the excavation by the otters was the ultimate cause of the obstruction of the creek and its final abandonment of that channel for the one now occupied on the opposite side of the marsh. At present no sign of an outlet to the burrow occurs at the foot of the bank, but directly opposite, at the bottom of the present stream, eight feet below the surface and seventy-five yards (estimated) from the clay bluff, lies the probable entrance to the burrow. My informant stated that this opening connected with it by a subterranean passage, so deep below the surface of the marsh that he had not been able to find any other inlet to it. To reach the bank, the otters simply dove to the creek bottom, and swam to it by their underground water-way, in the most perfect security.

"The character of the soil in this spot and the great depth of the clay is exceptionally favorable to the construction of such a refuge, and the steep, slippery face of the bluff would afford an ideal sliding-place for the sportive companies that must have formerly made this spot their rendezvous. A well-defined furrow down the steepest face of the bank still indicates the probable track of their coasting parties.

"On searching through the literature relating to the otter, it is apparent that no American author ascribes to this species unusual abilities in the construction of its home. Indeed, Dr. Coues concludes that 'its fossorial ability and the general intelligence it displays in the construction of its retreats have been greatly exaggerated by some writers.'* Dr. Merriam, in his 'Mammals of the Adirondacks' (page 91), says: 'The nest of the otter is generally placed under some shelving bank or uprooted tree.' In 'Godman's Natural History' (vol. 1, p. 224), we have a more explicit account, in which he states that the burrow is extensive, built in the bank of a stream or river, its entrance being under water, and the terminus being an air-hole opening in the midst of a bush or other place of concealment. Pennant says very much the same thing, but it is quite probable that some of these authors do not speak from actual experience. Dr. Coues admits that he has never seen the animal in its native state, and concludes from 'the shape of the fore limbs and condition of the claws . . . that the mining operations of the animal are necessarily limited,' and adds: 'It does not appear that the underground retreats of the otter are constructed with the skill and ingenuity of even those of the muskrat.'

"That so little should be known of these retreats hitherto is easily understood, when we consider the nature of the one unearthed on Pensaukin Creek. Only by a most unusual combination of circumstances was such a discovery made possible, and it was probably due to similar chance that the

* North American Mustelidæ, p. 316.

earlier British writers were enabled to ascribe to their otters those burrowing feats which modern authors have been at such pains to contradict, not on their own experience, but by pure analogical reasoning. I am persuaded that this Pensaukin habitation is not unique in the history of our New Jersey otters, in proof of which it may be stated that I received from the editor of 'The Friend,' a few days after the examination of this burrow, the announcement of another on the banks of Rancocas Creek, near Masonville. This was discovered by a hunter, who, while traversing the wooded bank of the creek, saw, to his consternation, a large pair of eyes staring from the ground. These were surmounted by a pair of horns, giving the object a most Satanic appearance They were found to belong to a cow, which had unwittingly caved into the dormitory of an otter, and was meekly awaiting the fate which her own exertions had so nearly sealed."

Description of species.—Because of its peculiar shaped, long, flattened body and tail and the very short legs, giving it a most salamander-like appearance, the otter is recognizable to almost every one. It has sometimes been mistaken for the beaver while in the water, but its supple, eel-like movements, long pointed tail and flattened head should quickly undeceive the careful observer. The northern or Canadian otter is distinguished from the race found in southern N. J. and the Carolinas by its darker hue, being a dark seal brown above; lower head and neck light Isabella color; remainder of lower parts nearly as dark brown as the back. In southern N. J. specimens the upper colors are vandyke brown tipped on upper head, neck and shoulders with wood brown; below, broccoli brown, the pale colors of lower head and neck sometimes faded to grayish buff. The webs of the feet in *canadensis* are densely hairy; in *lataxina* nearly naked.

Measurements (*canadensis*): Total length, 1100 mm. (43¾ in.); tail vertebrae, 420 (16½); hind foot, 120 (4¾); (*lataxina*) about the same sized body with larger hind foot. High upland specimens in any region are smaller than those from maritime marshes of the same latitude.

Southeastern Otter. *Lutra canadensis lataxina* (F. Cuvier).

1823. *Lutra lataxina* F. Cuvier, Dictionaire des Scien. Naturelles, vol. 27, p. 242.

1898. *Lutra canadensis lataxina* Allen, Bulletin Amer. Museum Nat. History, N. York, vol. 10, p. 460.

Type locality.—South Carolina.

Faunal distribution.—Upper and lower austral zones; southern Connecticut to Georgia, west to Texas and Great Plains.

Distribution in Pa. and N. J.—Lowlands of both states; most typical in lower Delaware Valley and southeastern N. J.

Records, habits, description of species, etc.—See data and remarks under preceding species.

Genus *Mephitis* Cuvier, Leçons d' Anatomie Compareé, 1800, vol. 1, tabl. 1.

Southeastern Skunk. *Mephitis mephitis putida* (G. Cuvier).

1798. *Must.*[*ela*] *putida* G. Cuvier, Tableau Elementaire de l' Histoire Naturelle des Animaux, p. 116.

1901. *Mephitis putida* Allen, Bulletin American Museum Nat. History, N. York, vol. 14, p. 333.

Type locality.—Eastern Pennsylvania and N. Jersey, especially the region now comprised in Philadelphia, Delaware, Camden and Gloucester counties.

Faunal distribution.—Adopting Howell's restriction of the habitat of this skunk (North American Fauna, No. 20) it is found in the lower Canadian, transition and upper austral zones; Maine to N. Carolina, west to Indiana.

Distribution in Pa. and N. J.—Mostly abundant and generally of uniform distribution over our whole territory, but like some other of our mammalia is of very rare and fortuitous occurrence in many parts of southern N. J. It is most abundant in rocky hilly country covered with deciduous growth, and becomes rare in extensively forested regions of coniferous timber.

Records in N. J.—The skunk is exceedingly rare in Camden Co. I have not seen one in my life, but have smelt them twice in the last 30 years. It is not rare, in fact very abundant, according to Dr. T. P. Price, in certain parts of Ocean and east Burlington Cos. A few are found in Cape May Co. In west Burlington Co. it is rare, as also in Gloucester Co. It is stated by Mr. W. S. Williams to be extiuct in the region around Greenwich, Cumberland Co., though formerly plentiful.—Rhoads, 1902.

Habits, etc.—So implicitly does the skunk rely on its foul-smelling battery, it often acts in the most peculiar ignorance of the common laws of self preservation. If you come upon one abroad in the day time it acts as if short sighted or unconscious of your presence and is likely to run almost against you before it discovers its mistake. Meanwhile if you are an ignorant, timid person you run off and tell some one you have been attacked by a skunk. If more courageous, you may kick or throw stones and finally wish you had done as the timid person did. After careful and painful study of Mr. Skunk, both in his house and in mine, I think him the incarnation of that curt, inelegant, but often wholesome maxim, "Mind your own business." Fortunately his poison is not deadly; his fur, under more elegant names, is an abiding source of comfort to those who despise and fear him most, and his absent-minded, patient, mincing ways and curious arts disguise an ento-

mologist and herpetologist whom farmer and scientist may take more kindly into confidence. Among other services done to the agricultural interests of the state, Dr. Warren secured a series of answers from his farmer and naturalist friends as to the economic status of the skunk in Pa. These voice, with notable exceptions, the popular prejudice against this animal entertained by those who never take the time to seek the good side of a disreputable thing; but the experience and testimony of Dr. Merriam and others who have studied this question show that the skunk is the most indefatigable and voracious feeder on all sorts of larger insects, grasshoppers, beetles, cut worms, white grubs, etc., that can be found among the mammalia. The harm they do is chiefly in the line of robbing bird's nests of eggs and young, and the destruction of poultry. As they cannot climb, these depredations are confined to the ground. Skunks fall a prey to foxes, wild cats, weasels, minks and large hawks and owls, but they are generally let alone while less offensive food is obtainable. Their meat is white and well flavored, resembling chicken. Their retreats are generally dug in the face of a steep slope, much as those of the woodchuck, whose burrows they sometimes use. Sometimes they use rocky caverns or hollow logs for shelter and breeding. Being prolific, with as many as 8 young in a litter, they increase very fast unless checked by normal conditions. Their furs average about 50 cents each; black ones as much as $1.50. The bite of a skunk under certain conditions has proved fatal, with symptoms like hydrophobia.

Description of species.—All of our skunks are black and white. In general terms the farther north you go the more black they become. But there is a wonderful variety of colors in any part of Pa. and N. J., some of the blackest skins coming from the lower Delaware valley and very light ones from the southern Alleghanies. The standard pattern of color is black with stripes of white more or less wide along the sides and a white stripe from near the nose reaching back between eyes to a half-collar or ruff of white on back of head. The tail is tipped with white. In the blackest specimens the white stripe between the eyes is always present, though often reduced to a mere line or spot. An examination of Howell's definition of the specific differences claimed to exist between the Canadian skunk, *Mephitis mephitis*, and our Pa. and N. J. animal indicate clearly their non-separability. I have therefore made *putida* a sub-species or race of *mephitis* in my classification. As but one form of skunk is to be found in our limits, measurements are unnecessary.

Genus *Gulo* Storr, Prodromus Method. Mammalium, 1780, p. 34.

Wolverene; Glutton; Carcajou. *Gulo luscus* (Linnaeus).

1766. *Ursus luscus* Linnaeus, Systema Naturae, vol. 1, p. 71.

1823. *Gulo luscus* Sabine, Franklin's Narrative, Journal to Polar Sea, p. 650.

Type locality.—Hudson Bay.

Faunal distribution.—Arctic, Hudsonian and Canadian Zones; Atlantic to Pacific Oceans; South to Pennsylvania and Colorado.

Distribution in Pa. and N. J.—Never found in N. J. A rare (the rarest) animal in Pa. in the early half of the 19th century. Even then only found in the most boreal localities of the state as a straggler.

Records in Pa.—Potter Co.—"C. C. Burdette, hunter, told me of the killing of one on Pine Creek many years ago. One was caught in a wolf trap near Great Salt Lick, Portage township. I think Joseph Nelson, of Wharton township, caught it. I saw it, but no one knew what it was, nor ever saw another like it. This occurred about 1858."—Austin, 1900. "Uncle J. P. Nelson killed a wolverene in Potter Co. on the east fork of the Sinnemahoning in 1863."—Seth Nelson, 1898. These two records, coming to me from entirely independent sources, and from hunters of so much intelligence, indicate that one and the same individual is referred to. The disparity in dates, of 5 years, is not surprising when memory alone furnishes record of an event happening half a century previously. So great and long continued has been my friend Austin's experience as an original settler, hunter, naturalist, justice of the peace and historian in Potter Co., I feel no hesitation in accepting this record. It is attested by the aged brother of the man who killed the animal, namely, Seth Iredale Nelson, another pioneer in the settlement of the Sinnemahoning, still living at Round Island, and whom I know by acquaintance to be a man of great intelligence and experience as a hunter, and a man of strictest truth. These remarks are made because it is the only record known to me of the existence of the wolverene in Pa., made by living witnesses to the fact. Up to the present time northern New York was considered their most southern range in the Middle States, no records of it even there being dated later than the one from Rensselaer Co. secured by Audubon and Bachman in 1811. It has been long considered extinct in the Adirondacks. So distinctly marked, large and peculiarly shaped an animal as the wolverene would not only be recognized as a novelty by any Pa. trapper or woodman, but would be identified quickly in any community of average intelligence, much more by the fur dealers with whom they traded. The only other record of this animal in Pa. that I have discovered is in Stokley's "Observations on Mercer Co., Pa.," published in the Memoirs of the Penna. Historical Society, 1846, vol. 4, p. 77. In this he enumerates the animals of the county, then covering a much larger and more mountainous area than now. He says that there were found still in the county at that date, "A very few white hares and an animal called the wolverene, supposed to be engendered between a fox and a wild cat, never taken by white man and rarely by Indians." I hope that these remarks may stir up the memory or unspoken

knowledge of other instances, where this peculiar, carnivorous and fur bearing animal may have been captured or seen in our limits.

Habits, etc.—For its size, which is about equal to that of a bear cub of 6 months, there is not a more powerful, voracious, cunning and fearless animal than the wolverene. The most fabulous accounts of it were given by earlier writers. Dr. Coues, in his Monograph of the Fur-bearing Animals, p. 45, sums up its real character thus: The wolverene "is simply an uncommonly large, clumsy, shaggy marten or weasel, of great strength, without corresponding agility, highly carnivorous, like the rest of its tribe, and displaying great perseverance and sagacity in procuring food. It is imperfectly plantigrade and does not climb trees like most of its allies. It lives in dens or burrows and does not hibernate. It feeds upon the carcasses of large animals which it finds already slain, but does not destroy such creatures itself, its ordinary prey being of a much humbler character. It is a notorious thief, not only of stores of meat and fish laid up by the natives of the countries it inhabits, the baits of their traps and the animals so caught, but also of articles of no possible service to itself; and avoids with most admirable cunning the various methods devised for its destruction in retaliation." They have their young in underground burrows. There are four or five in a litter, born in June or July. When surprised at large with her young the female is more aggressive and dangerous than a bear in the same situation. One of the most peculiar actions which has been observed in the wolverene is the shading of its eyes by the fore paws when gazing at an object of sudden surprise or fear, especially a man. This action is evidently done for the same reason that would induce a short-sighted person, or one blinded by sunshine, to shade their eyes under similar circumstances. The fur of this animal is most highly prized by the natives of the fur countries, the Kamtschatkans saying that "the heavenly beings wear no other furs" than these. They form a considerable fraction of the importations to London of the Hudson Bay Co., 1,104 being sent in 1868.

Description of species.—Legs, short; when in motion, back high-arched, body drooping fore and aft, tail and head carried low, looking like a shaggy bear cub with a bushy tail. Tail thickly clothed with hair four to eight inches long, shortest near the body, longest at tips, and drooping, the whole tail looking like that of a moderately docked horse whose tail has not been trimmed for a long while. Ears short, rounded. Color, blackish or deep dusky brown, a peculiar broad stripe of chestnut or yellowish brown or whitish clay color reaching from behind the shoulders and along the sides, meeting on the rump that of the opposite side, almost enclosing a dark patch along the middle of the back which reaches the neck and head. Whitish and yellowish patches are found on the sides of head and on throat and breast. Very young ones are of a general creamy color.

Measurements.—Total length, 969 mm. (38 in.); tail vertebrae, 200 (8); hind foot, 170 (6¾).

Genus *Putorius* Cuvier, Regne Animal, 1817, vol. 1, p. 147.

Northeastern Mink. *Putorius vison* (Schreber).

1778. *Mustela vison* Schreber, Saugthiere, vol. 3, p. 463.
1830. *Putorius vison* Gapper, Zoölogical Journal, vol. 5, p. 202.
Type locality.—Eastern Canada.
Faunal distribution—Lower Arctic, Hudsonian and Canadian zones. Great Slave Lake, Hudson Bay, Atlantic Ocean, northern Pennsylvania. lower Great Lakes and the Rocky Mts. enclose the habitat of this species; replaced in the southeast by *lutreocephalus*, next considered.
Distribution in Pa. and N. J.—The typical Canadian form is not found in N. J. In Pa. it is numerous in the most boreal mountain areas of the northern border. It is the form named by Audubon and Bachman *Putorius nigrescens*, or "mountain mink."
Habits, description of species, etc.—See next, under Southeastern Mink.

Southeastern Mink. *Putorius vison lutreocephalus* (Harlan).

1825. *Mustela lutreocephala* Harlan, Fauna Americana, p. 63.
1896. *Putorius vison lutreocephalus* Bangs, Proceedings Boston Society Natural History, vol. 27, p. 4.
Type locality.—Maryland.
Faunal distribution.—Transition and upper austral zones, Connecticut to South Carolina, Atlantic Ocean to Rocky Mountains.
Distribution in Pa. and N. J.—Abundant or represented sparingly along all watercourses in our limits, except where replaced by the northern mink, *P. vison*.
Habits, etc.—The mink is essentially an amphibious animal, second only in aquatic feats to the otters in the family *Mustelidæ*. It is much more at home on land than the otter, however, and on this account makes numerous and often persistent raids on poultry some distance from water, in this respect showing its affinity to the weasels. Fish form a large part of its diet, and its destruction of these (especially of the brook trout and other game fish) owing to its abundance as compared with the otter, makes it a serious pest to anglers. It also destroys birds and eggs, cray-fish, frogs and batrachians to a small extent. It is an accomplished and persistent mouser after the meadow voles which abound in its chosen haunts, and is also the most deadly wild enemy of the muskrat. Dr. Warren summarizes his reports concerning the mink as showing that it is a noxious species which should be suppressed in

every practicable way. As its fur is of considerable value there is little fear however that they will ever be so numerous as to become a plague. The burrows of the mink are made in banks near or along watercourses, though sometimes they take possession of a hollow log and there have their young. The latter number 5 or 6, though as many as 10 have been noted in minkeries. The period of gestation is 6 weeks. The difference in size of the males and females when grown is not so great as in the weasels, the female mink weighing about 1½ pounds, the male ½ pound more. The minkeries alluded to are places where these animals are raised for the same purposes as the European ferret. They are easily tamed, make excellent ratters, hunt vigorously and soon exterminate these pests. Other minkeries breed the minks for their fur to profit. The average values of raw mink furs (northern Pa.) run from 50 cents to $1.50.

Description of species.—The mink is readily distinguished from any of our eastern weasels by its larger size, stouter body, uniform brown color and bushy tail. From the marten it may be also known by its unicolor body and the shortness of its tail and ears. In size the marten is somewhat larger, and much longer furred. Nearly all minks have a white spot or spots on the breast, a peculiarity shared by nearly all the *Mustelidæ*. The northern species, *vison* typicus, is a much darker seal brown (sometimes nearly black) than the southeastern mink, *lutreocephalus*. The latter on the Carolina coasts becomes a sort of yellowish brown and with shorter, less dense and less marketable fur. The southern race is larger than the mountain mink.

Measurements (*vison*).—Total length, 520 mm. (20½ in.); tail vertebræ, 185 (7¼); hind foot, 55 ($2\frac{3}{16}$); (*lutreocephalus*)—635 (27); 210 (8¼); 70 (2¾).

Bonaparte's Weasel, Lesser or Short-tailed Weasel. *Putorius cicognani* (Bonaparte).

1838. *Mustela cicognanii* Bonaparte, Iconograph. Fauna Italia, vol. 1, fascic. 22, p. 4.

1839. *Putorius cicognanii* Richardson, Zoölogy of Beechey's Voyage of the Blossom, p. 10.

Type locality.—Northeastern North America.

Faunal distribution.—Hudsonian, Canadian and upper transition zones; Atlantic Ocean to Lake Winnipeg in the north and Rocky Mountains in the south.

Distribution in Pa. and N. J.—A very rare animal; only found in the most boreal situations in Pa. None have come to notice from N. J. Bangs' record of it from Long Island I am inclined to question. Miller includes the whole transition zone in their habitat and surmises that the upper austral

may be invaded by them. This scheme of distribution will not apply to Pa. and N. J. Indeed, it was only by the most assiduous search among many hunters, trappers and taxidermists that I was able to secure the first authenticated specimen of Pa. *cicognani*, the many reports of such as I have investigated proving with two exceptions to be females of *noveboracensis*, the common long-tailed weasel of the eastern U. States.

Records in Pa.—(In general.) "The least weasel, according to the best information obtained from local naturalists throughout the state, does not appear to be of very frequent occurrence. In fact quite a number of zoölogical students who are believed to be entirely competent to distinguish both species, report the least weasel to be rare or unknown in their localities. Mr. George P. Friant, of Scranton, Penna., during the past 10 years has had over 100 weasels taken within a radius of 25 miles of his home, and of these not more than 3 or 4 were the smaller species. The experience of Mr. Chas. H. Eldon, taxidermist of Williamsport, Penna., is very similar to that of Mr. Friant. During the past 8 years the writer has collected zoölogical specimens in almost every county of the state, and in a collection of 70 odd specimens (of weasels) at least 6 were of the small kind. From evidence at hand it seems that the least weasel is to be found in the northern and mountainous regions of Pennsylvania, and I am inclined to think it more plentiful than some observers and writers believe."—Warren, Poultry Book, p. 422. Dr. Warren adds that 75 weasel skins which he had were burned with the Pa. State capitol in 1897, so that he could not name the localities from which the least weasels came.

Lackawanna Co.—In January, 1902, I visited Mr. C. P. Friant, of Scranton, who kindly presented me with a skin of Bonaparte's weasel in summer coat, which had been taken by a boy in the city limits of Scranton in 1900. This specimen I deposited in the Academy of Natural Sciences. Mr. Friant had previously written me in 1900: "The last lesser weasel I recall having mounted was for a Mr. Smith who died soon after and I can't trace the specimen. I have mounted 3 in the last 10 years. I have no doubt that they were the species you designate as compared with the common weasel," of which he had mounted and handled a great number.—Rhoads.

Sullivan Co.—There is a very small weasel up here which turns white in winter. Not positive of its identity.—Behr, 1900. Mr. Behr has since trapped eight or more weasels near Lopez in the winter of 1900–'01 to prove that he has seen the species, but all of them were *noveboracensis*. Most of them were sent in spirits to the Acad. Nat. Sci., Phila., where I examined them. This is one of the best proofs of the great scarcity of *cicognani*, even in the most boreal part of the state.

Wayne Co.—An adult female *cicognani*, No. 4280 of my collection of mammals, was sent me in the flesh by Mr. L. N. Goodnough, of Wayne Co.,

Pa. He trapped it on a rocky hill near Rileyville, Dec. 2, 1900. It is in full winter pelage. Mr. Goodnough writes: "I killed one of the same kind about 40 years ago in Wayne Co. It had carried 12 small chicks to a pile of stones." As Mr. Goodnough is a trapper in a wild country, often capturing weasels, the fact of his only seeing 2 in 40 years in this part of the lower Canadian fauna is further evidence of the rarity of *cicognani* in Pa.

Habits, description of species, etc.—See under next species—*P. noveboracensis.*

New York Weasel, Common Weasel, Long-tailed Weasel. *Putorius noveboracensis* Emmons.

1840. *Putorius noveboracensis* Emmons, Report Quadrupeds Massachusetts, p. 45.

Type locality.—Southern New York.

Faunal distribution.—Canadian, transition and upper austral zones; southern New England to the Carolinas, west to Mississippi Valley.

Distribution in Pa. and N. J.—More or less numerous in all situations and regions of both states. Least abundant in the pine barrens and maritime regions of southern N. J.

Habits, etc.—Unceasing activity, boldness and rapacity characterize all our weasels. They are the incarnation of blood-guiltiness and the death-dealing life. Dr. Coues has in his masterly style given us a vivid picture of the living appearance of this animal: "A glance at the physiognomy of the weasels would suffice to betray their character; the teeth are almost of the highest known raptorial character, the jaws are worked by enormous masses of muscles covering all the sides of the skull; the forehead is low and the nose is sharp; the eyes are small, penetrating, cunning, and glitter with an angry, green light. When the animal is glancing around with the neck stretched up and the flat, triangular head bent forward and swaying from one side to the other, we catch the likeness in a moment—it is the image of a serpent."

The weasel climbs trees with great ease, leaping about among the branches like a squirrel. It also has the habit of raising up on its hind legs and craning the neck about in making its observations. Its climbing feats enable it to pursue and destroy many animals which would otherwise escape and do escape the depredations of skunks, minks and other non-climbing members of this carnivorous family. On this account the weasel is the more obnoxious to birds than the others named. While the weasel is pre-eminently a mouser, its preference for forests largely confines its depredations along this line to species of *muridæ* which have little direct economic significance to man. When a weasel visits a rat-or-mouse-infested barn it quickly rids the premises of such vermin, but as they are ever on the move, the riddance is only tem-

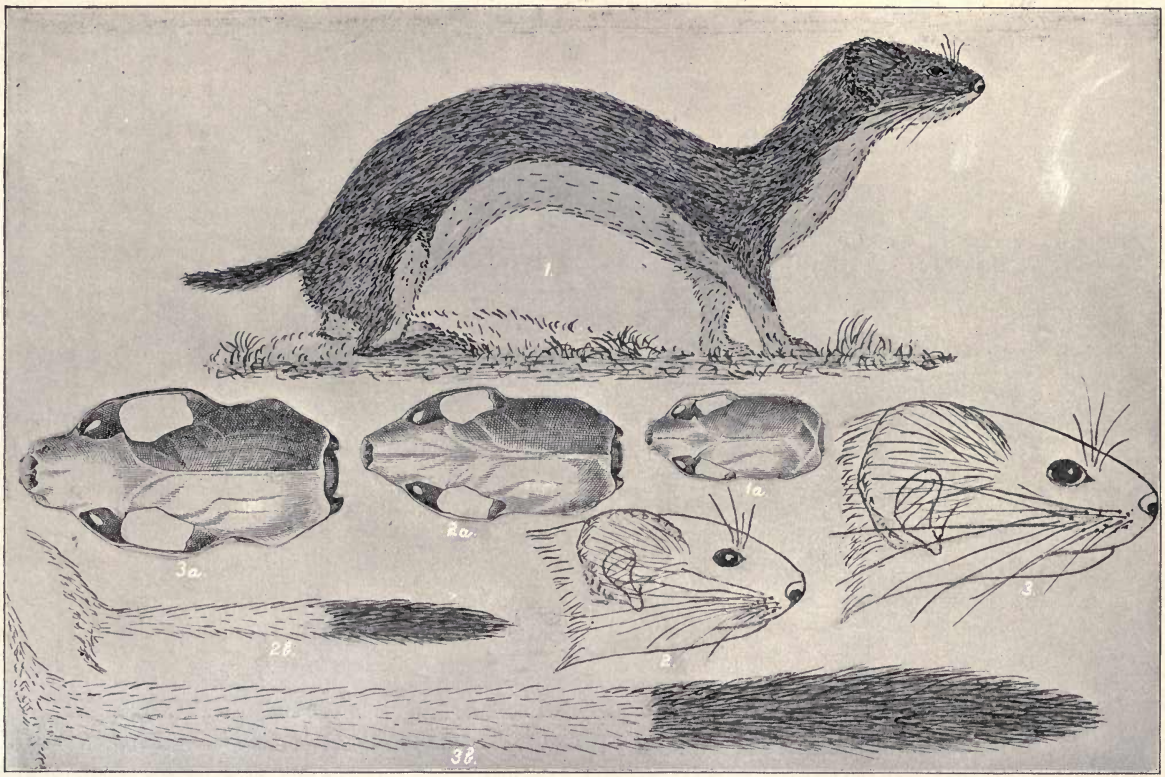
porary, and when the mice fail them they begin to destroy the farmer's poultry at such a rate as quickly counteracts their good services. The manner of killing its smaller prey is by a bite on the head. The brain is often the only part eaten. Its blood-sucking has been greatly exaggerated. Where many small, or a large animal, like a rabbit or fowl, is killed, they could drink but little, owing to lack of capacity. Dr. Warren, quoting Hugh Malloy, of Luzerne Co., Pa., who has made a specialty of weasel hunting and trapping, narrates some points regarding their habits which may be summarized. Malloy declares they never rest, but are always killing, summer and winter; even when snow was 8 inches deep and the mercury 7 degrees below zero, he was unable to catch up with one by tracking when the weasel was on a hunting journey. On one occasion he found "eleven dead rabbits," killed by a weasel along whose track in the snow he had followed. All these were "either hidden in the hole that they were started from, or pulled under the snow, sometimes 20 feet to some brush pile." These rabbits are killed by biting between the ear and eye, the wound being so small it is difficult to find. Regarding its capacity for blood he says it "has great digestive powers. I find when it is getting all the blood it wants, that in about every 20 yards in the snow you will find its excreta about ¾ inch long, thick as a slate pencil and like frozen blood." They do not kill old pheasants (grouse), but destroy many young ones. Quails are a favorite winter food, at night whole coveys being destroyed at once, and when found in spring are supposed to have been frozen or starved to death in snow-drifts. Malloy found in one place 100 quail thus killed, a small mark at base of head showing what the murderer had been. They track rabbits with great perseverance over snow or bare ground by the power of scent, and rarely give up the hunt till the rabbit is dead. The weasel often burrows long, deep and intricate passage-ways for its home in some bank. John Burroughs describes how he watched one of these (probably *cicognani*) make repeated journeys over a certain course in the woods from such a bank into the swamp, returning every few minutes with a mouse (probably *Evotomys*) which was stored in this burrow. As I remember, a score or two of mice were thus stored away while Burroughs sat watching the extraordinary feat. In attempting to unearth this cache Burroughs was completely baffled by the extent and windings of the burrow. They oftener hide and make their homes in stone heaps and rock piles. The young are said to number on the average 5 or 6 in a litter, born in April or May. In defending these they defy and attack any large animal, fastening upon them until killed.

Description of species.—The lesser weasel (*cicognani*) may immediately be distinguished from its associate, our common species, *noveboracensis*, by the relative shortness of the tail, that member rarely exceeding, in the male, 3 inches, and in the female, 2⅓ inches, whereas in the other species the males

have tails 5½ to 6 in. long and the females 4¼ inches. It should be noted that the size of the females in both species is ¼ to almost ⅓ less than that of the males (see measurements). On this account small females of *noveboracensis* are about the same size as large males of *cicognani*, but the difference in the length of tail between these is striking. Bonaparte's weasel always turns white in winter even in its most southern distribution, but the N. York weasel in the transition and austral zones very rarely turns white, the winter pelage being merely paler than that of summer. In the most boreal localities of Pa. the N. York weasel turns white in about 25 to 50 per cent. of the cases observed by me. Whether the special conditions of a forested or deforested environment, or of severity of weather or amount of snow-fall, cause this individual variation in winter pelage among the weasels of a given locality, I am unable to say. Regarding the real conditions as they exist in northwestern Pa., Malloy writes: "I do not believe there are any white weasels in summer, but I do know that they are dark brown, light brown, dark red and light red in winter and that I have caught them every week from Dec. 1 until April 1. I caught a dark brown, a dark red and a pure white all in one night but at different places. I never caught a *maltese* weasel in winter but have caught many of them in summer." This experience tallies exactly with that of Mr. Behr, in Sullivan Co. I have a white winter weasel taken in Camden Co. a few years ago and brought to me in the flesh. Regarding this seasonal change of color in weasels, it should be understood that it is accomplished solely by molting, the new hair, whether brown or white, not altering its color, except from exposure and wear, from the time of its first appearance on the surface of the skin until it is shed again the next season. While this new brown or white coat is growing, the old is slowly falling out, giving sometimes a patchy, at others a peculiar faded, semi-white, appearance. This has given rise to the popular idea that the color of the old hair is changing either to brown or white, as the case may be. In no case of bird or mammal is a fundamental color change caused by the voluntary action of the individual or by any other normal force upon feathers or hair after these have once pierced the skin.

The pattern of coloration in summer, as well as the tint in the two species now considered, is essentially the same, viz: dark or liver-brown above, including tail, legs and head except lower jaw, white below, tip of tail black at all seasons; this tip being relatively long in the large, and short in small, species. In the larger species the under parts are often pale sulphur yellow.

Measurements.—(*cicognani.*) Total length, male, 285 mm. (11¼ in.), female, 225 (10); tail vertebræ, male, 77 (3⅛), female, 69 (2⅜); hind foot, male, 37 (1½), female, 30 ($1\frac{3}{16}$). In the same order, measurements for *noveboracensis* are: male, 405 (16), female, 325 (12¾); male, 140 (5½), female 108 (4¼); male, 47 (1¾), female, 34 (1¼).



1. ALLEGHENIAN LEAST WEASEL: *P. allegheniensis* (Type).

1*a*. Skull of *P. rixosus* (after Bangs). 2, 2*a*, 2*b*. Bonaparte's Weasel: *P. cicognani*. 3, 3*a*, 3*b*. New York Weasel, *P. noveboracensis*. All natural size. Skull figures after Bangs.

Alleghenian Least Weasel. *Putorius allegheniensis* Rhoads.

1900. *Putorius allegheniensis* Rhoads, Proceedings Academy Natural Sciences, Phila., p. 751. Issued Feb. 7, 1901.

Type locality.—Near Beallsville, Washington Co., Pennsylvania.

Faunal distribution.—Unknown; probably Canadian and transition zones, southern Alleghenies northward.

Distribution in Pa. and N. J.—Not found in N. J. For distribution in Pa. see original description following, as also for *Records*, *Description of species*, *etc.*

Owing to the rather remarkable discovery of this species in a region so long ransacked by naturalists, I may be justified in giving at some length the original announcement of its discovery. Nothing further than this has been published, to my knowledge, concerning it, although Mr. Todd, of the Carnegie Museum, has since then strenuously endeavored to get more specimens. The description follows:

A New Weasel from Western Pennsylvania.

"One of the most unlooked-for results of recent systematic field study of smaller mammals inhabiting the settled and populous areas of the Eastern States is the discovery of a small weasel in the regions contiguous to the city of Pittsburgh. Fortunately three specimens have been secured, each representing a phase of pelage characteristic of the seasonal moult. This weasel is allied to the minute Arctic and Canadian *Putorius rixosus* Bangs, being somewhat larger than *rixosus* and less than half the size of *P. cicognani*, the smallest species hitherto recorded from the Middle States. It may be diagnosed as follows:

Putorius allegheniensis sp. nov. Allegheny Weasel.

Type, No. 6195, adult, Museum of the Academy of Natural Sciences of Philadelphia. Captured by Robert Hawkins, near Beallsville, Washington county, Pa., about the year 1885 or 1886.

"*Description of the type.*—In size and color it resembles *Putorius rixosus* Bangs from the Saskatchewan, B. A., but larger, darker and more thinly furred. Skull broader and flatter, with interorbital space high, tumid and constricted posteriorly. No supraorbital ridges.

"*Color* (summer pelage).—Upper parts walnut-brown, abruptly separated from the pure white of under parts, the line of demarcation running from nasal pad along border of upper lip, through base of whiskers, just below base of ear, along median lateral line of neck to anterior base of shoulder; thence down anterior profile of foreleg to elbow, rising thence along posterior profile of leg to and along median lateral body line to flank, thence to heel and posterior thigh as on foreleg, rising and encircling anal region to lower base

of tail. Tail colored like back with some scattering white hairs at tip (extreme tip apparently missing). Forefeet and lower foreleg white; hind feet white only on toes and inside border. Whiskers mixed brown and white. The color areas occupied respectively by brown and white are almost exactly divided in equal parts. Compared with the type of *rixosus* and another summer specimen from Moose Factory, Hudson Bay, the type of *allegheniensis* is much darker and duller hued.

"*Measurements* (of type, a well-mounted specimen, but undoubtedly stretched).—Total length, 199; tail without hairs of tip, 19; hind foot, 20. Skull: Basilar length, 29; zygomatic width, 15.3; mastoid width, 14; interorbital constriction, 6; greatest mandibular length, 16.5.

"*Description of two other specimens.*—No. 4279, Coll. of S. N. Rhoads; young adult (sex undetermined), cotype, in late winter early pelage, collected by aforesaid R. Hawkins, near Beallsville, Washington county, Pa., about the year 1885 or 1886.

"*Color.*—Everywhere pure white except on head, where brown summer fur is appearing, also about 15 dark brown and blackish hairs at tip of tail.

"*Measurements* (specimen is a mummy, preserved without skinning, having been eviscerated, poisoned and wired to a stand erect on its haunches. On this account its tail and body measurements are of real value after allowing an increase of five per cent. for shrinkage of intervertebral tissue).—Total length, 145; tail vertebræ, 22; hind foot, 20. Skull: Basilar length, 28; zygomatic width, 14.7; greatest mandibular length, 15.8.

"No. $\frac{5}{2}\frac{1}{1}\frac{7}{7}$, adult female, Coll. of the Carnegie Museum, collected by William Seager, near Leetsdale, Allegheny county, Pa., April 25, 1898. This interesting specimen is in the shape of a cabinet skin, with anterior half of skull attached to lips and without sex mark or measurements on label. I have determined its sex by the series of teats, evidently those of a female having nursed young the previous season. The skull and teeth indicate full maturity. The pelage is changing from winter to summer garb, this change appearing to have but recently begun.

"*Color.*—White, except an irregular mottled stripe of brown, well defined on head between nose, eyes and ears, narrowing along neck and back with wider areas at shoulders and hips and disappearing on hind rump. Tail white with about 20 brown-black hairs at tip almost concealed by surrounding white hairs. A faint mottling of brown is appearing on all four legs and the upper hind feet.

"*Measurements* (skin stretched).—Total length, 175; tail, 22; hind foot, 20.

"The two Beallsville specimens were kindly loaned to me October 27, 1899, by Mr. Jacob Nease, of Washington, Pa., in response to a circular, widely distributed in the State, requesting information concerning certain

rare mammals. The size of these tiny weasels, so different from anything to be expected from that region, raised the question of their being a genuine Pennsylvania product, and I wrote Mr. Nease for particulars. In answer, Mr. James S. Nease, who conducted the entire correspondence on the subject for his father, Jacob Nease, to whom the specimens belonged, sent me the following letter:

"'BEALLSVILLE, *Pa.*, 11–6–1899.

"'MR. JAS. S. NEASE, WASHINGTON, PA.

"'*Dear Sir:* In reply to your letter of 2d inst., I have consulted father in regard to the weasels which he sent your father to have stuffed. They were caught under dead-falls set for skunks, and of course were wild as any weasel. Father remembers well of catching them and sending them up, and got one or two he did not send, but has not seen any since then, some ten or fifteen years ago, if memory serves him right. They were caught when the bounty was on hawks and owls.*

"'Very truly, J. W. HAWKINS."

"While there seemed to be no question as to the statements of the gentlemen above mentioned, the publication of them was deferred nearly a year, when I was unexpectedly confronted with the specimen in the collection of the Carnegie Museum. As it had been taken along the Ohio river, only a few miles below Pittsburg, by a resident collector regularly employed by the Museum, it was accepted as conclusive evidence that these weasels are indigenous and living in those parts.

"Regarding the affinity of *allegheniensis* with *rixosus*, it may be stated that the nearest localities from which the latter has been recorded are Moose Factory, Ontario, and Pembina, Minnesota, the latter being the specimen mentioned by Prof. Baird under '*Putorius pusillus* Dekay' in the Pacific R. R. Reports. It will be seen that there is an immense stretch of territory between these places and Pittsburgh, besides the great difference in the faunal position of the localities. That the habitat of these weasels shall prove to be continuous through the Appalachian system from Ontario southward is not impossible, but that specimens from the intermediate country have as yet escaped notice is indeed strange. The facts now known to us as to the difference between *rixosus* and its southern ally in size, cranial proportions and color are sufficient to indicate specific values. It is singular that all the known specimens of *rixosus* and *allegheniensis* appear to be females, though in every case the sex has not been absolutely determined. If any of them are males the great difference in size between the sexes, so notorious in all other species, is not apparent among the least weasels. Mr. Bangs, in his

* This bounty act was passed in May, 1885, and repealed about eighteen months later.

monograph of these mammals, gives as a special character of *rixosus:* 'Tail not tipped with black'—but I find that his type of that species has several distinctly blackish hairs among the brown ones at the tail tip, so also has the specimen examined from Moose Factory. I am indebted to the Messrs. Nease for consenting to part with the type, on condition that it be preserved in the Academy of Natural Sciences of Philadelphia, as well as for their co-operation in this investigation. Mr. Outram Bangs generously loaned me the two specimens of *rixosus* mentioned above, one of them belonging to the Museum of Comparative Zoölogy of Cambridge, Mass."—Rhoads; see Proc. Acad. Nat. Sci., Phila., 1900, pp. 751 to 754.*

Genus *Mustela* Linnæus, Systema Naturæ, 1758, vol. 1, p. 45.

Southeastern Marten; American "Sable." *Mustela americana.*

1800. [*Mustela*] americana Turton, Linnæus, System of Nature, vol. 1, p. 60.

Type locality.—Eastern North America.

Faunal distribution.—Hudsonian, Canadian and upper transition zones; Atlantic Ocean to Cascade Mountains, there intergrading into *M. a. caurina* Merriam.

Distribution in Pa. and N. J.—Once abundant over all the mountain regions of the two states and to a certain extent invading the foothills of the transition zone. Early exterminated in the latter areas and now only known from the less deforested regions of the higher Alleghenies. Wholly absent from any part of N. J.; probably exterminated there 50 years ago.

Records in Pa.—Cameron Co.—"Found in hard-wood timber. Received several light-colored pelts from Shippen twp. in 1894; got 3 from same township in 1895."—Larrabee, 1896. I have a skin taken in Cameron Co., and have seen others.—Friant, 1902. I have examined several marten furs above recorded by Larrabee and Friant.—Rhoads, 1902.

Clinton Co.—"Once abundant in the beechwoods of this and adjoining counties; now very rare; saw tracks of two in Clinton Co., winter, 1895."—Nelson, 1896. None reported in the Co. since that date.—Rhoads, 1902. "Mr. Thomas informs me that he caught 5 or 6 in dead falls on the head

*I am indebted to Mr. Todd for the following additional records of this tiny weasel. Both specimens are in the Carnegie Museum, Pittsburgh. One, a mumified skin and skeleton found in a museum of a Catholic school at Herman, Butler Co., Pa., by F. Altman. Its measurements are, length 188 mm., tail vert., 33 mm., hind foot 20.5 mm. As these were taken in flesh they are conclusive as to real size, indicating a longer tailed animal than was supposed. The specimen is of much interest as showing a dark, chocolate, mid-winter pelage and is unique in having same color on lower parts, with only the chin, throat and breast white, as in *Mustela.*

waters of Young Woman's Creek [Clinton and Potter Cos.], in 1868."—Cleveland, 1900.

Columbia Co.—"None known to me as killed in the Co. for 50 years. I hear them occasionally in the big woods on North Mountain at night."—Buckalew, 1900. A skin was sent to Krider's Phila. gun store by H. Coward to be mounted. Being mutilated it was presented by Mr. Coward to the Academy of Natural Sciences. He stated it was killed in his camp on the mountain north of Benton, having made a raid on their butter in the spring near camp. It is a female, No. 1563, A. N. Sci.: catalog., taken in fall, 1892. —Rhoads.

Crawford Co.—Formerly found in the Co.—See Huidecoper, Hist. Crawf. Co., 1846.

Elk Co.—"I know of some [recently?] taken by O. H. Day in Elk Co." —Goodnough, 1900. "Formerly found. Now few are seen."—Luhr, 1900. "A few left."—Clay, 1900.

Forest Co.—"Almost extinct since 1875."—Haslet, 1900.

Lancaster Co.—"Very rare, if not extinct."—Rathvon, Hist. Lanc. Co., 1869, p. 501.

Luzerne Co.—"I have two specimens secured near Pittston."—Campbell, 1902. The identity of these is questionable.—Rhoads, 1902.

McKean Co.—"There are a few martens yet, back in the forests, but they are scarce. The last in this Co. that I know of were caught by Thos. Mulkins in November and December, 1899. He caught 6 of them on Haven's Brook, Norwich twp. The last one he had mounted, and is now in his parlor at Eldred. It is a nice specimen, but very light-colored, about as light as I ever saw one."—C. W. Dickinson, 1901.

Monroe and Pike Cos.—"I could hear of no specimens of this former resident having been captured for many years."—Rhoads, Proc. A. N. Sci., 1894, p. 394.

Potter Co.—"I received 22 pelts from a hunter who trapped them on the east fork of the Sinnemahoning during the winter of 1894–'95."—Larrabee, 1896. "Formerly abundant here and easily caught for its fur. I have caught them as late as 1870, and a few have been caught later."—Austin, 1900. See under Clinton Co., Young Woman's Creek Records.—Rhoads.

South Mountain, Bedford and Somerset Co. regions.—"Dr. M. W. Strealy, hunter and naturalist of Chambersburg, Pa., took considerable pains to inquire of old hunters of the South Mountain region concerning the presence of this animal. Among these persons was an old furrier whose father had all his life been in the same trade in that section. Another informant was a mountaineer 98 years old. Mr. Strealy states that neither of these men had ever heard of the marten or sable being taken in the South Mountain or the counties of that region."—Rhoads, Proc. A. N. Sci., Phila., 1897, p. 218.

Inquiries of the same character made farther west in Bedford and Somerset counties elicit the same kinds of answers. This is surprising, as the region is more in the faunal zone, preferred by the marten, than Pa. and N. J. localities once known to be its habitat.—Rhoads, 1902.

Sullivan Co.—"Found in several thickly-wooded parts of Sullivan and Wyoming Cos. I saw tracks of some in the winter of 1899–1900. I caught a female, Feb. 1, 1901, which I mounted for myself. A male [caught in March? same year] I sent to the Academy of Natural Sciences."—Behr, 1901. Still found in North Mountain.—Buckalew, 1900. "One was trapped near Eaglesmere last winter [1895–'96]."—Bennett.

Tioga Co.—Once found in all deep woods.—Hays.

Wayne Co.—Always rare in this Co.; none left.—Goodnough, 1900. "Plenty in beech woods 30 years ago. Not now seen."—Stevens, 1900. Extinct; once plenty.—Teeple, 1900.

Wyoming Co.—"A few still remain on the mountains."—Robinson, 1900. See also Behr, under Sullivan Co.

Pa. in general.—"Present, but only in small numbers, in a few sparsely-settled sections of Cameron, Potter, Clearfield, Clinton, Sullivan and Elk counties. Fur dealers claim from 25 to 50 are annually taken in this state." Warren, Poultry Book, 1897, p. 503.

Habits, etc.—This animal, more than any other of its family, is an arboreal species. For this reason, more than any other perhaps, has it become so nearly exterminated in the mountains of northern Pa., where it once abounded. While easily trapped and a desirable fur in Canada, the Pa. martens were never so eagerly sought after, owing to their light color, as to have been greatly reduced on this account. Owing to the prevalence of forest fires in Pa., their habits peculiarly placed them at a disadvantage in the struggle for existence as compared with more terrestrial species having their homes under ground. My correspondents agree in saying that deciduous, hardwood timber is preferred by this species in Pa. This seems at variance with its preferred resorts in Canada. In all localities the marten is ever shy and retiring from the abodes of man, unlike its kinsfolk, the mink and weasel, almost never disturbing domestic animals. Its food consists largely of squirrels, birds and their eggs, small rodents and insectivora, toads, lizards, frogs and even fish. When we consider the value of its fur, the marten may well be regarded as a most useful animal in the economic sense. The number of their furs exported from Canada in the past has been equal to that of all the other species of furs combined. Richardson states that about 100,000 skins were annually collected in the fur countries for many years, and Dr. Coues says that their numbers do not seem to diminish in these unsettled regions as time goes on. The marten usually makes its home in a hollow tree or in the nests of the gray squirrel, which it evicts without ceremony. It is prolific, bearing 6 or 8

young at a litter. The strong, musky odor or stench of the mink and weasel is not so noticeable in the marten.

Description of species.—The marten is nearly 1½ times the size of a mink, with a long, bushy tail, somewhat less than half the length of head and body. Its head and ears are larger in proportion to the size of body than in the mink, and it is in some degree a bicolored animal like the weasel. Above, it is a light, rich brown, slightly paler on the underparts; the throat or breast with a light, tawny or whitish patch, becoming orange in darker, richly colored specimens. A male Pennsylvania specimen from Lopez, Sullivan Co., in winter pelage is brownish buff on sides, darkening on back, tail and legs to blackish brown, the end of feet and tail being sooty. The broad median stripe of breast and belly is browner than sides; the irregular throat and breast patch is ochraceous; the top and lower head are Isabella color, lightening to ash on side of head and inside ears. Its length is 22 inches, tail vertebræ, 7 inches; hind foot, 3 inches.*

Pennant's Marten; Fisher, Pekan. *Mustela pennanti* Erxleben.

1777. [*Mustela*] *pennanti* Erxleben, Systema Regni Animal, vol. 1, p. 470.

Type locality.—Eastern Canada.

Faunal distribution.—Hudsonian, Canadian and transition zones; Atlantic Ocean to Cascade Mountains.

Distribution in Pa. and N. J.—While I have discovered no other record of this animal in N. J., either historical or otherwise than the one given by Dr. Abbott, it undoubtedly occurred in former days in the northern sections of the state. Its distribution in Pa. was at one time almost universal, except in the southern lowlands. Never numerous like the marten, it has now become almost extinct. A few remain in the higher mountains.

Records in Pa.—In 1897 I wrote (Proc. Acad. N. Sci., Phila., pp. 218, 219)—"The Fisher or Black Cat has for many years been practically extinct in Pennsylvania. Such at least is the verdict of nearly every hunter with whom I have communicated; and many men of middle age, who have had 20 years experience in mountaineering, never saw the track of one where they were formerly numerous, while many other trappers had not even heard of such an animal."

Cameron Co.—"Mr. Larrabee of Emporium, Cameron Co., declares there are yet a few in Shippen township. The tracks of one were seen and traps set to catch it during the winter of 1895–'96."—Rhoads, 1897.

Clinton Co.—"A fisher-fox was seen near Mill Hall a year ago."—Pfoutz, 1901.

* See Rhoads, Proc. Acad. Nat. Sci., Phila., 1902, for a Synopsis of the American Martens.

Columbia Co.—"A few have been killed in my memory in this county."—Buckalew, 1900.

Dauphin Co.—The living animal from which Audubon made his figure in Quadrupeds of N. America was taken by S. F. Baird "in company with an older one in Peter's Mountain, 6 miles above Harrisburg," in early February, 1844.—See p. 312, vol. 1.

Forest Co.—"John Bush, of Tionesta, killed one about 1893 on the ice of the Alleghany River. Its sale to a fur dealer proved its identity as a fisher fox."—Irwin, 1900.

Lackawanna Co.—"I recently saw one of two fishers which were killed by Martin Crippen, of Olyphant, about 1885. It is in the collection of Dr. Isaiah F. Everhart, of Scranton. This specimen and the other, which was kept by Crippen, were mounted by Mr. G. P. Friant, of Scranton, who personally furnished me the data. They were associated, and had been living some time near Olyphant in a den or burrow, making occasional raids on the farmers' poultry."—Rhoads, 1902.

Lancaster Co.—"On March 11, 1896, a fine male Pekan was shot by Christ S. Nunnemacher on the borders of a wood on Mill Creek, 2 miles north of Bird-in-Hand and about 3 miles east of Lancaster. Mill Creek rises in the Welsh Mountains. This animal had been making depredations on the farmers' poultry in that vicinity for some months and was finally discovered by some dogs that accompanied Nunnemacher. The animal was taken to Dr. M. W. Raub, of Lancaster, to be mounted, and the stuffed specimen is now in his possession. In a letter from Dr. Raub I have received full confirmation of the above facts and unmistakable evidence that the animal was *not* a "Marten," as reported in the Lancaster newspapers of that date."—Rhoads, Proc. A. N. Sci. Phila., 1897, p. 219.

Monroe and Pike Cos.—"Of the Pekan, *M. pennanti*, none of the inhabitants whom I asked had any knowledge."—Rhoads, Proc. A. N. Sci., Phila., 1894, p. 394.

Perry Co.—"The animal may be still found occasionally in the mountains north of Carlisle in Perry Co. [Peter's and Cove Mtns.]."—Coues, Fur-Bearing Animals, 1877, p. 68.

Potter Co.—"The elder Seth Nelson [told me] he caught many of them in the beech woods of Potter and Tioga Cos., between the years 1827 and 1845."—Rhoads, Ibid., 1897, p. 219.

Sullivan Co.—"In 1874 Mr. M. S. Prescott, Harveyville, Luzerne county, says: 'One was killed on Loyalsock Creek, in Sullivan Co.'"—Warren, Poultry book, p. 503. "They say that fishers were here 40 years ago."—Behr, 1900.

Tioga Co.—See under Potter Co.—Rhoads. "About 1853 I shot one in Ward township on the Tioga river, the only one I ever saw, and have heard of none since."—Cleveland, 1900.

Wayne Co.—"I caught one in central Oregon township, Dec., 1857. It was a female which had lived in the vicinity at least 2 years."—Goodnough, 1900. "Cousin Geo. Stevens caught one at the head waters of Butternut Creek about 1879."—Stevens, 1900. "Extinct; once numerous in this county."—Teeple, 1900.

Pa. in general.—From reports of N. York City and Penna. fur dealers and shippers it is learned that probably not over half a dozen Fishers are now annually killed in this State. At the present time about the only counties where these animals are to be found are Clearfield, Cameron, Elk and probably Clinton, Potter and Sullivan, and in all of these they are reported to be very rare."—Warren, Poultry book, 1897.

Record in N. J.—"Rarely met with. None exist in the central part of the State; probably none in the southern section. About the mountains in the northern counties a few are still living, but in no appreciable numbers." —Abbott, Geol. N. J., 1868, p. 753.

Habits, etc.—I am indebted to Dr. Coues' monograph of the *Mustelidæ* for the following notes on the life history of Pennant's marten. Unlike the marten, mink, weasel and wolverene, the pekan has no counterpart in the Old World. It is in appearance and habits much like a large marten, only its expression is more dog-like, and it seems to prefer low, wet grounds and the banks of streams, whereas the marten is an upland, hill-haunting species. Its commoner name of fisher is misleading, as it does not catch fish any oftener than a cat, though showing a feline fondness for them when they can be stolen. The name, pekan, is of doubtful origin, but probably an aboriginal name. Its food is similar to that of the marten, consisting largely of small rodents, but it is said to be very fond of the porcupine, and to also kill the marten and racoon for food. It shows great address and agility in climbing trees, and makes its home in a lofty hollow where the young are also hidden away from danger till able to go abroad. They number three or four. When brought to bay the pekan is most courageous, proving a much more dangerous foe to dogs than the fox. Audubon states that this animal is more strictly nocturnal than many others so-called. Ross don't agree as to this, and says they do not keep so closely to the woods as the marten, but often hunt mice on the large grassy marshes or prairies at the mouth of Slave River, B. A. It is almost as bad at stealing bait from the marten traps as the wolverene, which animal it is said to resemble in many characteristics. On account of their rarity this species' depredations never brought it into strained relations with economic zoölogists.

Description of species.—Size about three times that of marten. Body relatively much stouter. General aspect fox-like or dog-like, with rounded, broad ears and a long, rounded tail, gradually tapering to a slender point from a large, bushy root, the hairs quite long. The neck, legs and feet are much

stouter than in the marten and the claws much longer and stouter. The fur is coarser and looser than the marten's, with coarse, shining, bristly hairs intermixed. The color is variable but a general pattern and hue prevails. It is darker below than above; belly, legs and tail being almost black. The upper parts lighten more and more as the head is reached, from brownish-black to grayish or even hoary-brown or tawny. The usual patches of lighter color (white) are found on chest, arm pits, or even the belly between thighs. Old specimens are the lightest colored, some become nearly white.

Measurements.—Total length, 890 mm. (35 in.); tail vertebræ, 355 (14); hind foot, 120 (4¾).

Family PROCYONIDÆ; Racoons.

Genus *Procyon* Storr, Prodromus Method. Mammal, 1780, p. 35.

Northeastern Racoon; Coon. *Procyon lotor* Linnæus.

1758. [*Ursus*]*lotor* Linnæus, Systema Naturæ, vol. 1, p. 48.

1819. *Procyon lotor* Desmarest, Dictionaire d' Histoire Naturelle, vol. 29, p. 91.

Type locality.—Eastern United States.

Faunal distribution.—Lower Canadian, transition and austral zones, New England to Georgia, west to Rocky Mts.

Distribution in Pa. and N. J.—Uniformly numerous in all wooded tracts in the two states except those most populous in the near vicinity or suburbs of towns. Often found even in these situations as an explorer after poultry.

Habits, etc.—These are so familiar, I will merely allude to their economic status. Dr. Warren reports several answers from correspondents which condemn this animal as a stealer of fish, especially trout. Others say it does not catch many of these but is after cray fish chiefly. His raids on nesting turkeys I can vouch for, the eggs being sucked. His destruction of poultry is occasionally severe and he likes green maize ears dearly. No doubt he is a destroyer of birds' nests, eggs and young, both terrestrial and arboreal. He catches some mice, but being a slow sort of fellow, prefers more leisurely employment. On this account, he is quite a vegetarian, grapes, nuts, fruits and certain vegetables falling to his share. His furs for warmth and his carcass for food about compensate for the direct losses sustained by humanity in his depredations. Warren, however, thinks him entitled to persecution, a thing to which the coon has become so accustomed that probably neglect would be a more speedy means of extinction. We all devoutly wish his survival, however, as being one of the most characteristic Americans that welcomed Columbus.

Description of Species.—The "coon" may be immediately distinguished from all other of our eastern mammals, large or small, by its club or baton-shaped, cylindrical tail, adorned with alternate black and yellowish gray rings, each about an inch wide. In size and shape he is rather similar to a cub bear 6 months old. The resemblance to the bear in many respects led Linnæus to put the raccoon in the genus *Ursus*. His hind feet are plantigrade as in the bear, and make a track like that of a child. He is peculiar in being able to use the forefeet with such dexterity as to resemble the movements of the human hand. The face and expression of the coon is foxy, at the same time having some of the elements of the marten, wolverine, and fisher, his near relatives. The general color is coarse grizzled gray with tawny or brownish suffusion of the under fur showing among the longer hairs.

Measurements.—Total length, 830 mm. (32¾) in.; tail vertebræ 250(9⅞); hind foot, 120 (4¾).

Family URSIDÆ; Bears.

Genus *Ursus* Linnæus, Systema Naturæ, 1758, vol. 1, p. 47.

East American Black Bear. *Ursus Americanus* Pallas.

1780. *Ursus americanus* Pallas, Spicilegia zoölogica, fascic, 14, p. 5.

Type locality: Eastern North America.

Faunal Distribution.—Hudsonian, Canadian, transition and Austral zones: Hudson Bay and Atlantic Ocean to Georgia; west to Pacific Ocean and Alaska.

Distribution in Pa. and N. J.—Once uniformly and abundantly represented in every county of the two states. Now almost exterminated in N. J., but occasionally crossing the Delaware from Pa. into Warren and Sussex Cos. An occasional one is seen in the cedar swamps of southern N. J., but not oftener than once or twice in 10 years. In the most densely populated counties of Pa. it is unknown, in about half of those remaining it is found only as a straggler. In parts of the remaining counties it is almost as numerous as ever known to have been. In other sections, where deforesting of coniferous woods has been succeeded by scrub oak, chestnut, beech, briars, vines and berry-producing plants, it has increased in numbers and may be said to be abundant.

Records in Pa.—Bradford Co.—Thomas Leahy was reported to have killed a *brown* black bear in Bradford Co. in 1882.—Brown.

Bucks Co.—"One was tracked in snow and chased across country from Bear Swamp, Mercer Co., N. J., in the winter of 1870, through Rocky hill to

Washington Crossing where it crossed the Delaware River on the ice and was lost in Bucks Co., Pa."—Ray, 1901.

Cameron Co.—More plentiful than 30 years ago.—Hays, 1900. "Abel Andrews and his sons have killed 23 in Cameron Co. in the years 1894 to 1899."—Cleveland, 1901.

Centre Co.—Less abundant than 30 years ago."—Fenton, 1900. Common in Centre Co.—Rothrock, 1900.

Clearfield Co.—More plentiful than 30 years ago.—Hays.

Clinton Co.—Seth I. Nelson and his son, with whom I have hunted and trapped bears near Round Island, concur in the belief that they have been more numerous in that region in the past 20 years than before that time. About the year 1883 the junior Nelson killed 7 bears in East Keating township alone. In 1893 he killed 4. In October, 1898, under his directions, I trapped two in one week within a quarter mile of each other near my camp on top of the mountain. Their signs in the chestnut woods were so abundant and fresh that a novice might have supposed a score passed along these feeding grounds every night. These conditions prevailed over a stretch of country reaching the borders of Cameron and Potter Cos. Wherever the mast was abundant the bears had been correspondingly numerous and active.—Rhoads, 1902. Increasingly common in Clinton Co.—Rothrock, 1900. More plentiful than 30 years ago.—Hays, 1900.

Columbia Co.—"I have known of none in this Co. for 50 years."—Buckalew, 1900.

Crawford Co.—Extinct. Last one seen near Meadville in 1834.—Kirkpatrick, 1900.

Elk Co.—A few killed yearly.—Clay, 1900. "In some years as plenty as in former times. Ten or 12 killed in 1898."—Luhr, 1900. More plentiful than 30 years ago.—Hays, 1900.

Forest Co.—Very plenty. More so than 30 years ago.—Zendle, 1900. Quite plenty in big forests.—Haslet, 1900.

Franklin Co.—"Exterminated in the South Mountain regions."—Strealy, Spg., 1897. "In November, 1897, a bear devastated the region of Cove Mountain between Sylvan, Franklin Co., and Hancock, Maryland."—Strealy, 1899.

Lackawanna Co.—I handle a skin now and then killed in this Co.—Friant, 1900.

Luzerne Co.—"Taken every winter in east Luzerne Co."—Stocker, 1900. "They seem to be increasing."—Campbell, 1900.

Lycoming Co.—"Increasing yearly.—Parker, 1900. Seely Bovier killed a *brown* black bear in 1882 in Monet township. It was a male ⅔ grown.—See True, Proc. Nat. Mus., Washn., 1882, p. 653.

McKean Co.—Nearly as plenty as 30 years ago.—W. C. Dickeson, 1900.

Mifflin Co.—One killed in 1897 by David Harshberger in this Co.—Rothrock, 1900.

Monroe and Pike Cos.—"I handle about 6 or 8 skins every season killed mostly in Pike and Monroe Cos."—Friant, 1900. "Rarely killed, but evidences of their existence are frequently seen in the mountains. They hibernate here in severe winters."—Rhoads, 1894. Yet found in Pike Co.—Rothrock, 1900, Campbell, 1902. About as many in Monroe Co. as 30 years ago.—Bisbing, 1900.

Potter Co.—Some caught yearly in Potter Co. They are migratory, seeking mast. In an unfruitful season very scarce.—Austin, 1900.

Somerset Co.—"The last one seen and killed was 30 years ago."—Moore, 1899. "Very rare; one killed near Elk Lick about 4 years ago."—Mier, 1902.

Sullivan Co.—"The bear holds its own in this region."—Behr, 1900. "I think black bears are more plenty than 30 years ago."—Bennett, 1901. Mr. Bennett has trapped two more "red" bears near Eaglesmere. A claw with the "red" hairs attached and the skull of one killed in the fall of 1899 was sent to me and are in my collection. They belong to the brown variety of the black bear.—Rhoads, 1902.

Tioga Co.—Not plentiful as formerly.—Cleveland, 1900. They are increasing.—Babcock, 1900.

Union Co.—Increasing every year.—Chambers, 1900.

Venango Co.—About 2 per year are brought into Oil City.—Dorworth, 1900.

Washington Co.—One said to have passed near Washington town 40 or 50 years ago.—Nease, 1900.

Wayne Co.—Very rare. Last taken by Elijah Teeple in 1873.—Teeple, 1900. Many killed yearly in southern Wayne and Pike Cos. More numerous than 25 years ago.—Stevens, 1900. Almost extinct in the county.—Day, 1900.

Westmoreland Co.—One was seen crossing the road from Laughlintown to Jenner, on Laurel Ridge in July, 1898, by a gentleman who told me of the fact a few hours after. I am informed by Mrs. Fry, of Laughlintown, that one was seen (or killed) in the Co. in the present winter, 1901–02.—Rhoads.

Wyoming Co.—I caught 2 this fall and get 2 to 4 every fall."—Robinson, 1900.

Records in N. J.—Atlantic Co.—"I killed 8 bears *straight* in south Jersey in my early days. The last known to me was killed by Billy Campbell near Estelville."—Coffin, 1897. The very severe weather this winter has proved the supposed extinction of the bear in south Jersey to be unfounded. The following clippings are from the "Public Ledger," Philadelphia. They cover the adjoining corners of Atlantic, Cumberland and Gloucester Cos. There is so much evidence here presented, and of such a character, as to make it worth recording.—Rhoads.

"VINELAND, *Feb. 7, 1902.*

Farmers near the Blackwater Swamp are very much excited over the incursions of a bear, which has been carrying off live stock. Old bruin, whose tracks showed that he had circled around the buildings of Farmer Stevenson a few days ago, prowled around the barn of George Lyons last night, his tracks being very plain in the snow and slush.

The bear has been seen by William Jones and William Saul, and Farmer Jones, near the lake, had two pigs carried off by the beast. He has been tracked into the swamp two or three times, but every time he succeeded in outwitting his pursuers. Hunting parties of farmers are still looking for the animal."

"VINELAND, *Feb. 14th.*

The villagers of Newfield and farmers thereabouts are greatly excited over bear hunts. Bruin was seen and shot at twice by hunting parties last night, and was pursued toward his lair in Blackwater swamp, where he made his escape.

The bold incursions of the bear during the last few days have greatly frightened the farmers. The tracks of the bear were first discovered where he circled around the barns of Farmers Stevenson and Lyons during the last snowfall. Then Bruin stole two pigs from Farmer Jones, of near the lake, and was seen by another farmer. Night before last the bear broke into the hog-pen of J. Pasqualin, near Forest Grove, killed a hog and carried off one small pig. While near the swamp around Maurice river, of which the Blackwater river is a tributary, Peter Surran's horse became frightened by the sudden appearance of Bruin and almost ran away.

Two bear-hunting parties organized at Newfield early last night, one being led by B. J. Buckman and the other by Joseph Louder. All the men had shotguns, and each party had a pack of good dogs. The dogs of one of the hunting parties finally got on the trail of Bruin, and young Louder shot at the beast twice, but, it being dark, the bear succeeded in fighting off the dogs and escaping. Another party will go out to-night in the hope of getting a shot at the animal."

Burlington Co.—See under Ocean Co.—Price.

Cape May Co.—The last black bear known near Dennisville was killed about 1858, when three others were seen.—Lee. "Quite plentiful at certain periods, particularly in the dense cedar swamps in the upper part of the county where 5 have been killed the present autumn." Beesley in Geol. Sur. of N. J.—C. May Co., 1857, Appx. "The last one killed was about 1878 at Long Bridge Swamp in upper or Dennis township."—Hand.

Cumberland Co.—See under Atlantic Co.

Gloucester Co.—See under Atlantic Co.

Mercer Co.—See under Bucks Co., Pa.

Ocean Co.—"A bear was seen by one of the Pharo boys crossing the Tuckerton R. R. ahead of his freight train as they were running through Manahawkin Swamp, about 4 years ago."—Pharo, 1893. "Very rare, if not extinct, in this Co. They lived later in Manahawkin Swamp than anywhere else in the vicinity of Tuckerton. Around Shamong and New Lisbon [Burlington Co.] there were more bears than near Tuckerton."—Price, 1900.

Passaic and Sussex Cos.—"No bears were reported to me as still existing in the localities visited [in 1896]. The recent killing of bears at Port Jervis, N. York, makes it possible that they occasionally wander into the northwestern corner of Sussex County."—Rhoads—Proc. A. N. Sci., Phila., 1897, p. 31.

Warren Co.—"A bear was seen in Warren Co. near the Water Gap about 9 years ago."—Davison, 1902.

N. J. in general.—"Fast disappearing from the state, now never met with in the central counties; in inappreciable numbers in the northern mountainous districts, and not more than half a dozen are annually killed in the southern section of the state. The bear has been the last of the three large carnivorous animals of the state to disappear before the settling and clearing off of the land."—Abbott, Geol. N. J., 1868, p. 755.

Habits, etc.—Perhaps no large mammal is better known to so many persons, old and young, than the bear. Zoölogical gardens, shows, the circus, literature and folk-lore all contribute to this stock of knowledge. A few facts not so well known may prove worth noting. The black bear is exceedingly wary and more fearful of man than a deer. It can be within 20 feet of you in thick woods or underbrush and escape without making a sound appreciable to the ordinary ear. At the same time its weight may be 350 pounds and its width 2 feet. There may be half a dozen bears feeding in a blackberry clearing, and the freshest signs of their feeding and resting and tramping everywhere evident over hundreds of acres, yet the most careful stalking, sneaking, listening and spying will not reveal their whereabouts. A small, nimble cur dog will quickly send the largest bear up a tree. If the hunter comes suddenly upon him in that plight, the bear will not always wait to climb down, but may drop from the farthest branch sometimes 20 or 30 feet upon its posterior parts and bounce off without apparent discomfort. In its terrestrial method of feeding and omnivorous diet, the bear is very much like a pig, but is at a great advantage over the pig owing to the powerful arms and claws by which it is continually digging, tearing and overturning the obstacles which protect its prey. In our latitude the bear only fattens when the berry and nut crops are abundant. Its spring and early summer diet of insects, mollusks, worms, mice, reptiles, birds' eggs and roots hardly makes life worth living for a voracious bear, especially if he has been forced into his winter den with only a small layer of fat and must come out and forage after every winter thaw. New-born bears are most helpless things; much as the young infant, almost

naked, quite blind and exceeding small, needing the unceasing attention of their mother for many weeks after birth, and in northern climes nature further insures their safety by sealing up the dam in an ice-bound cave, the loosening thaws of spring being her only hope of escape. The young number from 1 to 4, but 2 is the usual number. The bear at certain seasons, either of sexual activity or in search for an abundant food supply in autumn, becomes a migratory animal. On these accounts, especially in its search for mast, it is difficult to form an idea of their actual abundance or scarcity in a given region. The answers of my correspondents indicate this condition and some of them are shrewd enough to allude to it. Undoubtedly this ranging habit, coupled with the fact that they are often tracked long distances across country by hunters when found in places from which they have been exterminated, accounts for their continually "turning up" in out of way places. An exceedingly severe winter will also finally drive the last hermits of their race in such a place as the cedar swamps of N. J. into the haunts of man, resulting in their so-called rediscovery after years of supposed extinction.

I now give a brief summary of Mr. S. Nelson's long experience as a bear trapper in Clinton Co., Pa.: Meat averages 8 cents per pound in the mountains. Highly prized by natives. Heaviest known to him weighed 408 pounds dressed; before butchering 500 pounds. Fur brings $12 prime. Will eat carrion when starved, but if they can get nuts will reject all other food except honey, yellow-jackets and bumble bee's nests, and the chipmunks which they dig out in fall for their stores of nuts, and eat the proprietor also. They never hesitate when hungry to devour the porcupine, turning it over and eating the contents of his coat of mail without injury. The she-bear has young born in January. They are born 40 days after conception, the rut coming in November, and she goes into her den, stump or log in December. When born, young are absolutely hairless so far as can be seen, and so small that 3 can be held in one hand at a time, being the size of a half-grown guinea-pig, the head very large for size of body. They emerge with young about the last of March to early April. There are 2 to 4 cubs, sometimes only 1. The nest is made of sticks, bark, leaves and moss. These young "den up" with their mother the next season sometimes. The dam does not shed fur the year she has cubs. (By the last two statements I infer he means the bear does not bring forth oftener than alternate years.) The males only molt once per year, in late summer and fall. They will sometimes wantonly kill 2 or 3 sheep in one night. They also kill fawns.

Description of species.—Our east American bear is normally black with brownish markings about the nose and sometimes a white spot between fore-legs. A very rare occurrence is the capture of the brown or red variety in Pa. Three or four of these have been recorded above, and I am just informed that another was captured the present winter (1901–'02) in Sullivan Co., Pa

These are only a color phase of the black species, as I have ascertained by an examination of the skull and claws of one taken near Eaglesmere recently by Mr. Bennett. Cubs in the same litter have been found in the western U. States, one of which was black and the other brown. The same variations occur in the grizzly bear, *Ursus horribilis*. In the Alaskan mountains a small nearly white bear, closely allied to our black species, is found. A yellowish race of the black bear is found in Louisiana, *U. a. luteolus* (Griffith).

Measurements.—Taken from a 3 or 4-year-old male, trapped by S. N. Rhoads, in Clinton Co., Oct. 29, 1898. Total length, 1342 mm. (51¼ in.); tail, 106 (4¼). They sometimes grow to be 5½ feet long, and often weigh over 300 pounds when fat.

Order INSECTIVORA: Insect eaters.

Family SORICIDÆ; Shrews.

Genus *Sorex* Linnæus, Systema Naturæ, 1758, vol. 1, p. 53.

Eastern Masked Shrew. *Sorex personatus* I. Geoffroy St. Hilaire.

1827. *Sorex personatus* I. Geoffroy St. Hilaire, Memoir Museum d' Histoire Naturelle, Paris, vol. 15, p. 12, 122.

Type locality.—Eastern United States.

Faunal distribution.—Canadian, transition and upper austral zones; Atlantic Ocean to Cascade Mountains.

Distribution in Pa. and N. J.—Abundant chiefly in damp and marshy situations in the Canadian and transition areas of both states. Rare in the austral areas except on the maritime marshes where it is more abundant, perhaps, than in any other situation in our limits. Also numerous in the boreal bogs of the southern interior of N. J. The only specimens of this shrew I ever saw in the vicinity of Philadelphia were two. One was caught and swallowed by a chicken on my uncle's farm near Marple, Delaware Co., Pa. The other I trapped in a pine woods near Haddonfield, Camden Co., N. J. Two from Kennett Square, Chester Co., Pa., are in the Cope collection. Dobson records one from Haddonfield, N. J.

Habits, etc.—This is the least of our mammals, and being subterranean in its living and rare in upland tracts below the mountains, is seldom seen alive. Though I have trapped a great many, I never saw one alive outside of a trap. It not only makes tiny galleries through the moss, vegetable mold and loose sod of the places its frequents, but uses largely the burrows of the mice and moles which associate with it. That it is semi-aquatic there can be no doubt, as its runways often descend directly into subterranean springs, pools and

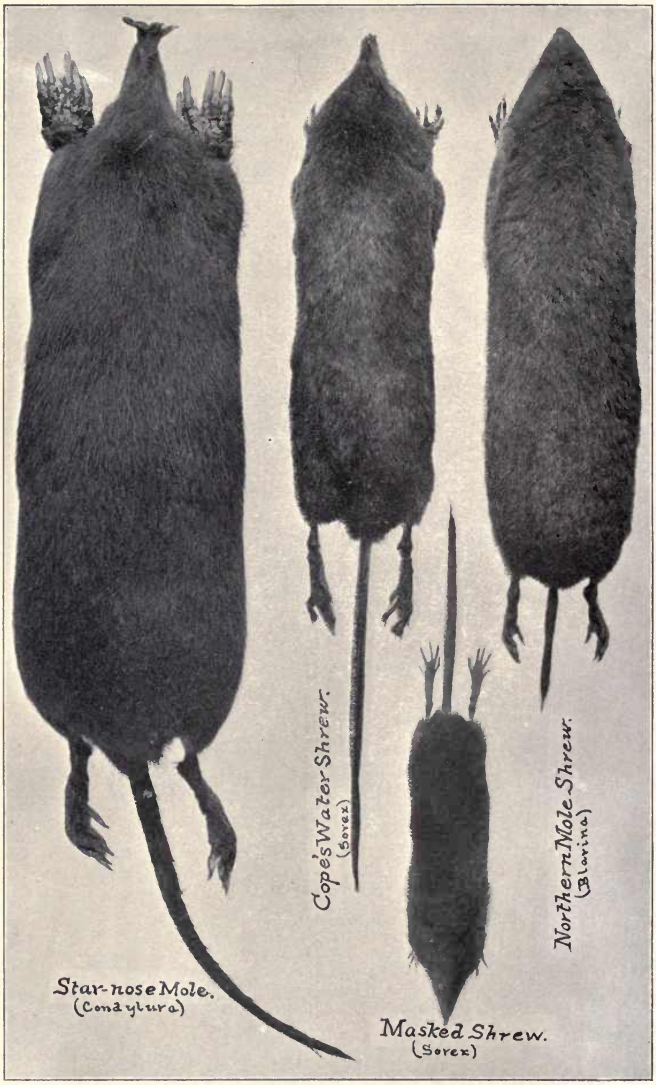
water courses, and on the tide marshes where it seems to flourish, it is often subjected to inundations which wholly submerge its haunts for many hours at a time. I have detected in its burrows the broken and emptied shells of the smaller snails which may be found in moss and decaying mold and under logs and the loose bark of rotting stumps. Of land snails the *Pupidæ*, *Helicidæ*, and *Zonitidæ*, and in fresh water species the *Limnæas* and *Physas* are preferred. What salt-water species they consume I cannot state, but no doubt the small mollusca and crustacea of the salt marshes are utilized. The insect diet of these shrews is no doubt large, but what species are preferred I cannot state. The freshly killed remains of small beetles in their burrows indicates *Coleoptera* as one of the class devoured. No doubt small, tender larvæ of all insects are preferred to the adults. That these tiny shrews are omnivorous is shown by their fondness for the cheese, raisins, cornmeal, oatmeal and pieces of meat with which they are attracted to a trap. They also quickly mutilate an unfortunate shrew or mouse which may be imprisoned in a trap, seeming to prefer the eyes and brains to other parts of the carcass. Their fondness for dead and even decaying animals is attested by Godman. The nest of this species I am not sure I have ever found, though one composed of fine grasses in a rotten log where they frequented seemed too small for any other species of mammal known to me. The eyes of this shrew are well developed like those of the short-tailed or mole shrew (*Blarina*). Owing to the length of tail, shortness of legs, weakness of feet and slenderness of body this shrew, is more like a weasel in build and habits than like a mole.

Description of species.—As there is only one other species of the long-tailed shrew, now known in our limits, which is likely to be confounded with the masked shrew, I will define both under this heading. The other species is the smoky shrew, *Sorex fumeus*, next considered, a much rarer species and confined to the mountainous regions of the two States. In those parts it is found associated with *S. personatus*. The latter is smaller and lighter colored, its hind foot being only ½ inch long, while the foot of *fumeus* is two millimeters ($\frac{1}{16}$ of an inch) longer. The color of *fumeus* is a general smoky slate-color throughout, but that of *personatus* is clear brown on the back and the underparts are whitish gray. The second and third upper front teeth of *fumeus* are twice the size of the fourth and fifth; in *personatus* there is a regular dimiution in the size of those teeth from the third to fifth.

Measurements (*personatus*).—Total length, 105 mm. (4⅛ in.); tail vertebræ, 40 ($1\frac{9}{16}$); hind foot, 12 (½); (*fumeus*) 115 (4½); 45 (1¾) 14 ($\frac{9}{16}$).

Smoky Shrew. *Sorex fumeus* Miller.

1895, *Sorex fumeus* Miller, North American Fauna, No. 10, p. 68.



ALL FIGURES NATURAL SIZE.

Type locality.—Peterboro, Madison Co., New York.

Faunal distribution.—Canadian and upper transition zones of eastern United States; southward in higher Allegheny Mountains to N. Carolina.

Distribution in Pa. and N. J.—This species is comparatively rare wherever found, as distinguished from the abundance of *S. personatus* in certain localities. In the swamps and spring-heads of the colder mountain tops, where the smoky shrew is most at home, *fumeus* and *personatus* are taken in about equal numbers. As the list of specimens will show, the smoky shrew is evenly distributed in Pa. within the Canadian and upper transition life zones. In N. J. I have only found it twice in counties of the northern border. The specimens taken by me in Beaver Co., Pa., indicate the nearest approach to the austral zone I have noted in this species.

Habits, etc.—I have never found this species in open country. It seems to confine itself to wooded situations, especially those where rocks abound. In its food and general manner of life it undoubtedly resembles the masked shrew living in the same places.

Description of species.—See above under *Sorex fumeus.*

Specimens examined or recorded.—Pa.—Beaver Co., Beaver, 2. Bedford Co., Hyndman, 1. Cambria Co., Cresson, several; Krings, 1. Clinton Co., near Round Island, 7; Renovo, 4. Forest Co., Parrish, 1. Monroe Co., Pocono, 2; Gresco, 1. Pike Co., Dingman's Ferry, 2. Somerset Co., Summit Mills, 2. Sullivan Co., Lakes Ganoga and Leigh, 9; Eaglesmere, 3. Susquehanna Co., Dimoch, 1. N. J.—Passaic Co., Greenwood Lake, 1. Sussex Co., near Culver's Gap, 1.

Eastern Marsh Shrew; Big Water Shrew. *Sorex palustris albibarbis* (Cope).

1862. *Neosorex albibarbis* Cope, Proceedings Academy Natural Sciences, Phila., p. 188.

1892. *Sorex albibarbis* Merriam, Proceedings Biological Society, Washn., vol. 7, p. 25.

Type locality.—Profile Lake, Grafton Co., N. Hampshire.

Faunal distribution.—Hudsonian and Canadian zones; Atlantic Ocean to Lake Superior; Labrador to Pennsylvania.

Distribution in Pa. and N. J.—Only known from a single specimen taken in northeastern Pa. Not likely to be found in N. J. May eventually be found in parts of the higher Alleghanies of Pa., but long-continued trapping with this object in view has failed to secure a second specimen. The extreme rarity of this shrew in our limits is thereby fully demonstrated.

Records in Pa.—The following is the original announcement of the capture of the eastern marsh shrew in Pa. It is quoted from the Proc. Acad. Nat.

Sciences, Phila., 1894, p. 395: "It is with no small satisfaction that I announce the discovery of a member of this subgenus [*Neosorex*] in Pennsylvania. One specimen was taken along the banks of a rocky stream flowing into the Big Bushkill, in Monroe county. It is the most southerly record for the subgenus, the previous southern record being Warwick, Massachusetts. After going over the ground somewhat, it appears proper to endorse the verification of Mr. G. S. Miller, Jr., in the Proceedings of the Boston Society of Natural History, in giving this shrew the name applied to New England examples by Prof. Cope, in 1862. Specimens from Lac Aux Sables, Quebec, and from Lincoln, Maine, agree better in the brownish cast of lower parts with Prof. Cope's diagnosis of *albibarbis* as contrasted with the 'ash-colored' belly of *S. palustris* given by Richardson in the Fauna Boreali Americana. In the Monroe county specimen, though identical in dentition and proportionate measurements with my Canadian specimens, the colors are much as in Richardson's diagnosis of *palustris*, showing that the brown belly character is inconstent in eastern specimens. It is probable, however, that the exceptions are in immature pelage. For a full discussion of these questions, see paper by Mr. G. S. Miller, Jr.," above referred to, vol. 26.—Rhoads.

Habits, etc.—I can find no satisfactory references to the habits of this animal. From its structure and the nature of the localities it frequents, it must be the most aquatic of our eastern shrews, confining its wanderings closely to watercourses and lakes.

Description of species.—In size about equal to large specimens of the mole shrew, *Blarina brevicanda;* nearly 10 times that of the small species of *Sorex* above treated. It is immediately distinguished from any American species of *Blarina* or typical *Sorex* by the large, relative size of the feet, the hind foot being very long, broad, bordered by a rim of stiff bristles and slightly webbed, all these characters adapting it to more aquatic life as contrasted with our other shrews. The tail is nearly as long as head and body and in most respects similar to that of *Sorex*. Color above blackish slate, sparingly mixed with light-tipped hairs, chin whitish or grayish, rest of under parts heavily clouded with dusky. Tail bicolor, blackish above, whitish below. The above is Merriam's description of eastern specimens supposed to be typical. Compare this with my remarks on the Pa. specimen above quoted. As the evidence in hand points to only a racial or subspecific difference between *palustris* of Minnesota and Alberta and the New England *albibarbis* I have so indicated it at the head of this article.

Genus *Blarina* Gray, Proceedings Zoölogical Society, London, 1838, p. 124.

North Eastern Mole Shrew; Large bob-tail Shrew. *? Blarina brevicanda* (Say).

1823. *Sorex brevicandus* Say, Long's Expedition Rocky Mountains, vol. 1, p. 164.

1857. *Blarina brevicauda* Baird, Mammals North America, p. 42.

Type locality.—Near Blair, Washington Co., Nebraska.

Faunal distribution.—Canadian, transition and upper austral zones; Atlantic Ocean to Nebraska and Manitoba; Quebec to Virginia; replaced southward by *B. carolinensis*, a distinct species. (See Proc. A. N. Sci., Phila., 1897, pp. 310, 311.)

Distribution in Pa. and N. J.—This species stands pre-eminent above all others of our mammals in its combined abundance and universality of distribution in all conceivable situations. Not a place have I trapped over in the two states but what it was among the first species to be caught. It is found in our deepest, coldest mountain ravines, on the stony, barren mountain top, in the banks and valleys of low tidewater streams and the maritime marshes, and delights in roving from the cool spagnum bogs of the N. J. cedar swamps, where the temperature may be below 60°, to the hot sand barrens of the adjoining fields with a midday heat of 110°. Forest and plain, sand and clay, barren or fruitful field, back woods and dooryard, heat and cold, wet and dry, day and night, have common charms for this cosmopolite.

Habits, etc.—It is supposed by some observers that the fetid odor emitted by certain glands of this species, more particularly the male, causes its rejection by all preying animals as cats, dogs, foxes, minks, skunks, weasels, owls and hawks. To a degree this is true, and I have found them lying dead in open places in the woodland or along lanes, paths and roads where they had evidently been dropped by foxes, and owls, as the wounds in the body showed. That they are not always rejected may be seen by examining the lists of stomach contents and pellets or rejects of several species of hawks and owls. Some cats and dogs will eat them. The most offensive males may be generally rejected, and I doubt not this odor has a deterrent effect upon would-be offenders, acting as a preservative of the species. The more I observe and inquire into the economy of the large mole shrew the more I am convinced that it is locally the most potent factor in preserving the economic equilibrium among the smaller mammalia which the Creator established as conserving the highest good of the greatest number. The following was contributed to the "American Friend," of Phila. (Nov. 26, 1896, p. 1149). It gives a brief sketch of the life-history of this interesting animal.

"It is surprising how few, even among very intelligent people, have the remotest conception of what constitutes a shrew. I venture that ninety per cent. of the persons I have conversed with on the subject have had no other idea of shrews than the kind depicted in Shakespeare's comedy, and when I gravely state to them that I have caught so many shrews the effect is rather amusing. Though rarely seen, even by the most curious observers of nature,

the subject of this article far outnumbers any other species of native mammal found in eastern North America. Like other members of its family it is insectivorous, depending almost wholly on animal food for subsistence, and with its near kinsman the mole, which it greatly resembles, is supposed to feed principally on worms.

It belongs to the genus *Blarina*, or short-tailed shrews, distinguished from the typical shrew of the genus *Sorex* by the abbreviated tail, and by slight differences in the structure of the skull and teeth. There are four or five species of these short-tailed or mole shrews in the eastern United States, but all yield in point of size, numbers, and universality of distribution to *Blarina brevicauda*. A full-grown specimen is about five inches long, less than one inch of this being devoted to the tail. The shape of the body and head, the character of the fur and the apparent absence of eyes suggests the mole, and many people undoubtedly confound the two, but an examination of the feet shows a decided difference, those of the shrew being shaped and placed more as in the mice, and the shrew never attains more than half the bulk of a full-grown mole.

It is to the *underground habits* of so many of our small mammals that we must charge much of our ignorance of this interesting class of creatures. Add to this the fact that their chief period of activity is at nightfall, and the wonder ceases. There are, however, means of getting at many of the secrets of their little lives, and it is surprising how much one can unearth by the judicious use of a few mouse-traps in the nearest bit of wild land, or even in one's own garden or lawn. Turn over fallen logs, boards, fence-rails, and stones, scratch among fallen patches of leaves or high grass, part the tussocks in the meadow or the sphagnum in some deep, shady bog, and ten to one, the first thing you are likely to catch in the intricate and innumerable runways and burrows that thread these places is *Blarina brevicauda*. Be it mountain or valley, forest or plain, rocky or sandy, wet or dry, hot or cold, in season and out of season, the professional mouse-trapper over the entire country from Hudson's Bay to the Carolinas, and from the Mississippi to the Atlantic Ocean, first, last, and all the time, expects to be bored with a superfluity of mole shrews. From the point of view of a respectable native mouse there cannot exist a more pestiferous busy-body, free-booter and cannibal than a *Blarina*. There is only one way of escaping his intrusions, and that is to climb a tree, but not one mouse in ten can do that. Some of the most valuable catches I ever made along a line of traps bear the tooth marks of this ferocious little meat-eater. Other specimens are often completely devoured, and often they devour each other. Confined in a vessel with much larger and more agile species than themselves they quickly vent their spleen at the restraint by persistently hounding their companions to death, and devouring them. In this way one of these shrews is stated by John Morden, of

Hyde Park, Ontario, to have eaten three times its own weight of meadow mice in twenty-four hours.

In view of their great numbers we naturally query what economic relations they bear to man and to nature. Undoubtedly the purely mechanical effect of their universal burrowing and rooting in the soil is an important factor in that economy. It is known that they subsist to some extent on vegetable food, chiefly nuts, but they do only indirect damage to agriculture by disturbing the roots of plants. On the other hand, there is little doubt that they destroy an amazing number of noxious grubs, beetles, and worms, and it is probable that the part they play as underground scavengers is important. They also do much in checking the increase of the native mice of our meadows and woodlands.

Of the domestic habits of the mole shrew we know very little, and that, in a general way, would seem to point toward anything but conjugal felicity or fidelity, and their fraternal relations may safely be set down as far below par.

A friend of mine who has long peered curiously into nature's secrets without a mouse-trap, relates that the only time he ever saw one of these creatures alive, its hind foot was being slowly chewed by another of the same species, which had firmly anchored itself underground in a position which would allow it to enjoy the repast without observation. The squeaks and struggles of its victim first attracted the notice of my friend.

The mole shrew builds a nest of grass and leaves in dry, underground situations, to which it resorts not only for its own shelter, but for that of its young. Four to six young compose a litter, and, as with our native mice, the young are born at all seasons of the year, though less frequently in winter."—Rhoads.

I may add that they eat a good many of the various genera of snails and undoubtedly devour certain of the salamanders and other batrachians and reptiles which haunt their burrows. For a discussion as to the false charges made against this animal by agriculturists read my previous remarks under habits of the northern pine vole, *Microtus pinetorum scalopsoides*.

Description of species.—For a general account see above quotation. The color is uniform, sooty slate-brown above, more ashy below. When the fur is smoothed flat it has the peculiar sheen or gloss of the mole. Specimens from southern N. J. are lighter colored and less sooty, nearly light slate in some cases. Having examined about 400 specimens of the large eastern *Blarina* from many localities between Quebec and Virginia, I incline to the belief that *Sorex talpoides* of Gopper should apply to this animal as a subspecies or race of typical *brevicauda* found in the Great Plains region. The specific separation of *B. carolinensis*, which I have previously advocated, removes the only objection cited by Merriam (N. Amer. Fauna, No. 10, p. 11) which may be considered as valid against this course. The varying dif-

ferences in size of eastern series from N. England, New York, etc., as cited by Merriam, do not show anything more than what we would expect. The variation among these is small, as I have just determined by averaging a very much larger series from Connecticut, Massachusetts, Maine, Quebec, Central Pa. and Northern and Southern N. J. in my collection. This only establishes the fact that Quebec specimens are about 5 millimeters longer (h. foot, 1 mm. longer) than those from Pa. and N. J., which latter do not materially differ in size. In short there is a uniformly smaller size and paler coloration in the *Blarinas* east of Nebraska. This pale coloration finds its extreme on the N. England and N. Jersey coasts. I believe the diminutive examples from Martha's Vineyard and Nantucket are insular forms which should not be considered in this connection.* As to the inapplicability of Gapper's name because given to an intermediate form, we have often had to accept such names in preference to using another. If, however, talpoides is not considered applicable we have a better name, given by Bachman in the Journal of the Academy of Natural Sciences, Phila., in 1837, to a specimen from northern N. J., viz: "*Sorex dekayi* (Cooper, mss.)." The alternatives would therefore be: *Blarnia brevicauda talpoides* (Gapper), 1830, or *Blarina brevicauda dekayi* (Cooper, mss., Bachman), 1837; habitat: Eastern Canada and the United States from Lake Superior and the Mississippi Valley to the Atlantic Ocean.

Measurements (series of 70 from Alleghany Mts., Pa.).—Total length, 122 mm.; tail vertebræ, 23; hind foot, 15. (Series of 30 from southeastern peninsula of N. J.), 120, 24, 15. (Series of 40 from northern N. J.), 122, 24, 15.5. (Series of 13 from Lac Aux Sables, Charlevoix twp., Quebec, Canada), 125, 26, 16.

Least Mole Shrew; Small bobtail Shrew. *Blarina parva* (Say).

1823. *Sorex parvus* Say, Long's Expedition to Rocky Mountains, vol. 1, p. 163.

1895. *Blarina parva* Merriam, North American Fauna, No. 10, p. 17.

Type locality.—Near Blair, Washington Co., Nebraska.

Faunal Distribution.—Austral zone, rarely into lower edge of transition; New Jersey to Florida; west to Texas and Nebraska, intergrading with *B. parva floridana* (Merriam) and in southern Texas with *B. parva berlandieri* (Baird).

Distribution in Pa. and N. J.—A rare species wherever found. I have only noted it in the lowlands of the two States, the most northern record being that given by Miller for the Hackensack marshes, Bergen Co., N. J. No

* Since this writing Mr. O. Bangs has described these insular *Blarinas* under the racial names *aloga* and *compacta*.—See Proc. N. Eng. Zool. Pub., 3, 1902, pp. 75–78.

record of it is known to me from southwestern Pa., where it may be expected to occur, however.

Records in Pa.— Chester Co.—An alcoholic specimen from West Chester is in the Cope collection at the Academy of Natural Sciences, Phila. A skin from Thorndale is in my collection.—Rhoads, 1902.

Cumberland Co.—Baird describes a specimen from Carlisle in Mammals N. America, p. 50.

Records in N. J.—Bergen Co.—"Mr. Frank M. Chapman writes me that there is in the American Museum of Natural History, a specimen of this shrew taken on then Hackensack marshes in New Jersey only a few miles from the New York State line."—Miller, Bull. N. Y. State Museum, 1899, p. 362.

Cape May Co.—Two specimens in my collection were captured near Cape May a few years ago.—Rhoads, 1902.

Mercer Co.—I found in pellets of long-eared owls kindly sent me by Mr. A. H. Phillips, of Princeton, N. J., 3 skulls of this species. The pellets were collected by Mr. Phillips in 1891, near Princeton.—Rhoads, 1902.

Ocean Co.—Merriam records 3 specimens from Tuckerton. See North Amer. Fauna, No. 10, p. 18. I trapped one several years ago on Barrel island, in Tuckerton Bay.—Rhoads, 1902.

Union Co.—Mr. Waldron Miller, of Plainfield writes that he found the skulls of 14 *B. parva* in 50 long-eared owl pellets collected in 1902, near Berkeley Heights. Strange to say, these pellets only contained 3 skulls of *B. brevicauda.*

Habits, etc.—Never having seen this animal alive, and having only trapped 3 specimens, my knowledge of it is very deficient. It is evidently at home in both marshy and upland grounds, and frequents the same hiding places as the masked shrew, *Sorex personatus.* Its capture on Barrel Island proves it must be an expert swimmer as neap tides often nearly cover everything on the island from sight, and the shrews have to cling to wreckage and drift for hours before regaining a foothold on the island.

Description of Species.—A short, chunky, bobtailed shrew with body about as long as that of *S. personatus* and *fumeus*, but twice as thick; the tail only half as long as theirs. Color above, sepia to dark hair brown; beneath, ash gray.

Measurements.—(Specimen from Cape May, N. J.), total length, 81½mm. (3¾ in.); tail vertebræ, 22 ($\frac{4}{16}$); hind foot, 11 ($\frac{7}{16}$); (specimen from Barrel Isl., Tuckerton Bay, N. J.), 87, 17, 11. By comparing these measurements, made in the flesh by the same collector from specimens taken in the same region, we see that Dr. Merriam's specific distinctions between *B. parva* and *B. floridana*, based on size, are set at naught. It would be interesting to know what the collector's measurement of the 3 Tuckerton, N. J.,

examples were. Dr. Merriam merely says they were larger than Raleigh specimens. The dental characters assigned to *floridana* and *berlandieri* are not sufficient for specific recognition. As above given, I prefer to recognize these merely as two races of *parva*.

Family TALPIDÆ, Moles.

Genus *Scalops* Illiger, Prodromus Systema Mammalium et Avium, 1811, p. 126.

Eastern Naked-tail Mole; Common Mole. *Scalops aquaticus* (Linuæus).

1758. [*Sorex*] *aquaticus* Linnæus, Systema Naturæ, vol. 1, p. 53.

1825. *Scalops aquaticus* F. Cuvier, Dents des Mammiferes, p. 251.

Type locality.—Eastern United States.

Faunal distribution.—Transition and austral zones, Massachusetts to Georgia, west to the foothills of the main ridge of the Allegheny and Blue Ridge mountains.

Distribution in Pa. and N. J.—So far as known to me this mole is found in every county in N. J. In Pa., east of the Allegheny mountains, it is generally and abundantly present in all lowlands and in river bottoms among the mountains, but as the mountains are ascended they disappear, being replaced by the Brewer's or hairy-tailed mole in the upper transition and Canadian zones. In Pa., west of the Alleghenies, all the evidence secured by the field work of Mr. W. E. C. Todd and myself, as well as the testimony of other observers, is against the existence of *S. aquaticus* in that region, all the specimens examined from the region proving to be either *Parascalops* or *Condylura*.

Regarding the distribution of this species, Dr. F. W. True in his monograph of the American moles (Proc. U. S. Nat. Museum, 1896) endeavors (pp. 8 to 10) to reconcile therewith the schemes of faunal distribution in North America, proposed by Drs. J. A. Allen and C. H. Merriam. He finds difficulty in so doing because Dr. Allen's map provides for an Alleghenian fauna, which almost cuts in half the distribution of *Scalops* as Dr. True has given it in his map. The real difficulty, however, is caused by Dr. True's lack of data regarding the distribution of *Scalops* in the Allegheny mountains. He says "it unquestionably occurs in the Alleghany mountains—that is, in the southern extension of the cold temperate or boreal area." On looking over his list of specimens examined, however, as well as his *authenticated* records from literature, I find none which prove it an inhabitant of this "boreal area," except the specimen from Roan Mountains (No. 54748 Dep. Agric. Coll.) mentioned on p. 451. This may have come from the side of

the mountain below the boreal summit, as in the case of the one from N. Carolina mentioned next in the table. This is confirmatory of my own investigations in the region named. It is also confirmatory of the correctness of Dr. Allen's faunal scheme so far as it relates to this region and of the incorrectness of Dr. Merriam's map mentioned by True, which includes the entire Pa. Alleghenian region in the "transition fauna." Dr. True's map of the Northern distribution of *Scalops* along the southern shore of Lakes Erie and Ontario, so far as it relates to Pa., Ohio and N. York, is, in the light of subsequent investigations, proved to be faulty, the Star-nosed and Brewer's moles being the only ones certainly recorded from these regions to my knowledge. The character of the evidence on which Dr. True included any part of the region north of the Great Lakes and the St. Lawrence, so far as given in his "Revision," is equally untrustworthy. Everything points to a more or less complete Alleghenian barrier, separating northern *S. aquaticus, typicus* from its western representatives, the only land connection being made around the southern end of the Allegheny system in northern Georgia.

Habits, etc.—The common naked-tailed mole of the region east of the Alleghenies seems to prefer open grounds to woodland, and is practically absent from large hemlock forests even in the lower transition zone. Alluvial soils, devoid of rocks and stones, they most delight in, but wherever the earthworm abounds, even in rocky and gravelly places, the mole follows suit in proportionate numbers. I have seen their characteristic sand heaps, by which their work may be distinguished from that of the mole shrew and the pine mouse, in the midst of the N. J. pine forests. In such places, however, the earthworms are very rare, and some other animal food must have been the attraction. The incessant digging, or rather ploughing of the mole, is accomplished almost solely by the use of the fore-legs and head, the weak hind legs being merely props in comparison. The fore-legs are nearly all feet in an external view, the powerful, short, massive shoulder and arm being hidden wholly by the contour of the body. When burrowing is going on the pig-like snout is set on a level with the bottom of the burrow, the shovel-like paws are extended directly forwards with their long nails against tip of nose on each side, and with a simultaneous upward throw of the nose and sidewise strokes of the paws, the earth is forced upward and sidewise as with a wedge. In surface digging and in moist, loamy soils, the earth is merely compacted laterally and raised vertically without extraordinary effort, not making conspicuous surface ridges, but when they must go deeper and in hard clayey or dry soils the strength exerted must be enormous, and where too solid for the compacting wedging process the soil must be removed by other means. In the mere traversing of this sort of ground the soil can be packed behind the animal, but as they generally wish to have a back door escape in emergencies, the burrow is completed by forcing the earth to the surface along lateral and

vertical shafts. This work casts up the large mounds of a half to quarter peck, sometimes seen in the grounds they frequent. How this earth is conveyed I cannot state. The mole is very suspicious of a steel or other trap set *into* the ground along its burrow and invariably fills it with earth, burrowing under or around it until it can regain the main passageway. At the same time it has no fear of repairing a tunnel which is repeatedly crushed in from above and is thus easily caught by a trap devised on that principle. In capturing a mole while it is digging near the surface one must be very alert and quick of movement, being sure to insert the spade or hoe several inches behind where he seems to be and throw out a good quantity of soil or he will escape by a sudden retrograde movement that is remarkable. The quickness and speed by which it can thus escape shows that it must run backwards in its open burrow, as the size of the burrow and the speed of its escape would not allow of turning. Godman describes their subterranean home:—"It was an oval cavity about 6 or 7 inches in length by 3 in breadth and was placed at about 8 inches from the surface in a stiff clay. The entrance to it sloped obliquely downwards from the common gallery about 2 inches from the surface. Three times I entirely exposed this all by cutting out the whole superincumbent clay with a knife, and 3 times a similar one was made a little beyond the situation of the former." Godman thinks them gregarious or living at peace in families, an idea I can concur in, having caught three or four individuals of different ages and sexes in the same burrow in a short period. This mole is active during winter in such places where the frost does not prevent its excavations. At this season it must work at considerable disadvantage in the northern limits of its range, having to burrow much more deeply to find the hibernating insects and worms on which it so largely subsists. That the mole voluntarily comes to the surface of the ground and so remains there is not conceivable when we observe its movements in that unfortunate plight. The snout is capable of exquisite discernment in discovering prey and the nature of things coming in contact with it and ability to take hold of and force into the mouth the living insects and worms encountered. It is continually in motion and serves largely the place of hands and eyes to an animal practically devoid of either.

One of the most interesting and important considerations regarding the mole is its relation to agriculture in particular and to nature in a more general sense. The following observations are quoted from articles published by me in Forest and Stream in 1898. The first was written in review of a Bulletin published on this subject by the Pa. Department of Agriculture in the same year. Its subject was "The Economic Status of the Mole," by Harry Wilson. I quote:

"On page 17 Mr. Wilson gives us some 'Miscellaneous Notes' on the common mole (*Scalops aquaticus*), which are of value as adding somewhat to

our knowledge of the habits of that species, the actions of this mole in swimming evidently being based on his personal observations, though the author fails to say so. The fact that *Scalops aquaticus* can swim, however, is not an argument in favor of the propriety of Linnæus's specific name, as Mr. Wilson inclines to think. The most strictly terrestrial mammals can, when forced to take the water, swim better than the common mole, and it remains a fact that our knowledge of the habits of this species shows it to be one of the least aquatic of the American *Talpidæ*.

In Part II. the economic relation of these moles to agriculture and their distribution in Pennsylvania is discussed. The economic question is treated on the basis of the examination of thirty-six stomachs of *Scalops aquaticus* taken in eastern Pennsylvania between June 19, 1896, and Oct. 13, 1897. No examinations of the stomachs of the star-nose mole are recorded. Fortunately these mole stomachs were submitted in several cases to the proper specialists, and the identifications can be relied upon as representing the fullest and most accurate record of the food of the common species throughout the year which we yet possess.

Of the 36 specimens examined, all contained animal food-matter; 27 had eaten earthworms in common with other material; 7 had eaten earthworms alone; 27 had eaten insects of which a large proportion were injurious species, as *Lachnosterna;* 9 had eaten insects only, and 10 had taken vegetable matter in connection with insect food. None had taken vegetable matter only. Only 2 of those containing vegetable matter could have devoured it intentionally; one of these had short sections of grass blades in its stomach, apparently bitten off piece by piece, but as this stomach also contained a June bug or May beetle, Prof. Howard thinks the mole was only indirectly responsible. In the other case the fragments of nearly a whole grain of corn were found.

Mr. Wilson's conclusions as to the economic status of the mole, referring in this case solely to the common *Scalops aquaticus*, may thus be summarized: 1. Stomach examinations with very few exceptions (and these perhaps fortuitous), acquit the mole of intentionally devouring vegetable food. 2. The mole is strictly insectivorous (independently of its earthworm diet), devouring a larger portion of injurious than of beneficial insects. 3. Having so proved it is equivalent to proving that its work is beneficial to agriculturists, the mechanical injury to vegetation due to its burrowing being more than compensated by its destruction of noxious insects. 4. The ravages of field mice and other small burrowing rodents which follow the runways of the mole are almost always the cause of the popular prejudice against the latter animal.

We agree largely with these conclusions so far as they go, and only wish that our author had been able to give judgment as to the star-nose mole. From what we know of its habits and distribution, however, as well as its

scarcity in arable lands, it is safe to say that a more harmless mammal than the star-nose does not exist.

An important and generally ignored subject in the economy of the mole is the significant fact that its food consists largely of earthworms. Most investigators seem to think that if it can be proved that the mole eats nothing but earthworms and insects, then he is clear of suspicion and an unmixed benefit to agriculture. One of Mr. Wilson's correspondents significantly says that he considers the common mole injurious to growing crops 'by its destruction of earthworms'! It seems most pertinent that the next question for our agricultural departments along this line of research should be first to decide whether Darwin's views as to the value of earthworms to soils and agriculture are correct. This once decided in the affirmative, it remains for the champions of the mole to prove that its destruction of worms is a necessary check to their excessive increase, and that the mechanical effects of the mole as a worker on soils are of greater value than that of the worms it destroys. Another matter, in which the mole figures largely in hilly districts, where the soils are easily washed by rains, is its agency in the denudation of top soils. In some parts of the Ohio Valley the effect of their tunneling on arable hillsides is most disastrous."

The second paper in Forest and Stream from which I make extract was on "Owls, Mice and Moles." The part relating especially to moles in this is as follows:

"Until lately we have known very little of scientific fact about the diet of our common mole (*Scalops aquaticus*). Under the direction of the Pennsylvania State Board of Agriculture, an expert examination of about forty stomachs of the common mole shows that only one had intentionally devoured vegetable food, and that all had largely depended on earth-worms, June bugs, click beetles and other "injurious" insects, earth-worms forming the bulk of their diet. There are more than two ways of judging these facts from the standpoint of economic zoölogy. Mr. Harry Wilson, the gentleman who conducted the inquiry, decides to his own satisfaction that any animal, if proved to be insectiverous, and not herbivorous or granivorous, is beneficial to the farmer. On these grounds he is content to rest his case, acquit the mole of wilful trespass, and commend him to the tender mercies of the husbandman. But the market gardener and the florist and the owner of a level lawn exclaim: "Not so; we will grant that he does not eat our seeds, vegetables, bulbs and grass roots, but he uproots and undermines them, and makes a thousand passageways in which noxious mice and shrews may forage and destroy."

One observer, Mr. E. H. Darlington, of West Chester, Pennsylvania, voices the opinion of another and a surprisingly small class. In answer to the questions: "Do you consider the mole injurious to growing crops? In what

way?" tabulated in the bulletin referred to, he answers: "By the destruction of earthworms." Mr. Darlington is the only one of forty correspondents who suggests that the earthworm diet of the mole is an injury to crops. Probably a much smaller proportion of the people than one in forty ever considered that phase of the question. We have become accustomed to watching the robins doing yeomen service above ground in this line, and unconsciously have got to thinking that the earthworm was made solely for dietary purposes. Darwin, however, has beautifully demonstrated* the hidden economy of the earthworm, and how its value as a converter of decay into food is only exceeded by its agency in tillage and the manufacture of arable soils.

In the light of this evidence, the fact, now fully recognized by zoölogists, that the mole is not a vegetable feeder marks, but one step in our investigations of its economic status. A second step in the right direction is the important discovery that it destroys a large number of insects. But the burden of proof, strictly speaking, yet rests upon the admirers of the mole. To these we would put three significant questions: (1) In its widest acceptation, is the mechanical action of moles on the soil more beneficial than injurious to vegetation? (2) Is the insect food of moles chiefly composed of species classed as injurious by recognized authorities? (3) Is the destruction of earthworms by moles an indirect injury to agriculture or a beneficial check to the excessive increase of the earthworm? The writer believes that the mole will eventually triumph in this controversy. The mole has been cleared of many accusations of ignorant and short-sighted people, and no doubt can satisfy the anxious inquiries of would-be friends. We have good reason to predict that our humble and industrious *Scalops* is unwittingly pursuing a wise economy in its varied relations to soils, drainage, forestry, agriculture and animal life, maintaining that wonderful balance of nature which man, above all other creatures, has conspired to disturb."

Description of species.—This mole is immediately distinguishable from Brewer's mole (with which it is so generally confounded in the higher mountainous districts and the lowlands of Pa. west of the Alleghenies) by its tail being only an inch long and apparently destitute of hairs, the skin being a whitish pink, like that of a white pig. In Brewer's mole the tail is ¼ inch longer and covered throughout with long, rather stiff, black hairs forming a sort of rounded brush far beyond the end of the tail proper. In size there is no great difference between the species; in color Brewer's is the darker (brownish slate) animal. From the star-nose mole, which has a disk of radiating fleshy rays on the end of the nose and a long thick, almost naked, black tail, there is no difficulty of separating our common upland *Scalops*. A

* "The Formation of Vegetable Mould through the Action of Worms." Charles Darwin. New York, 1882.

race of *Scalops aquaticus* found in western Ohio and the Mississippi Valley beyond, is of a much lighter (silvery or yellowish drab) color. Whether a modified form of this race (*machrinus*) is to be found in Pa., in the lowlands of Greene, Washington and Beaver counties, is worthy of research. So far no specimens of any other moles than Brewer's and the star-nose have been received from western Pa., nor do I know of any authentic records of *Scalops* from there.

Another animal confounded with the mole is the large mole shrew (*Blarina brevicauda*), but they are immediately separable by an examination of the fore feet, those of the mole being flat, wide, circular and ten times the size of the shrew's, the latter resembling those of a mouse. In color the two animals are quite similar, as also in the peculiar quality of the fur.

Measurements.—Total length, 162 mm. (6⅜ in.) ; tail vertebræ, 27 ($1\frac{1}{16}$) ; hind foot, 16.5 (⅝).

Genus *Parascalops* True, Diagnoses of New North American Mammals, 1894, pt. 2 (Proc. N. S. Nat. Mus., vol. 17, p. 242).

Brewer's Mole, Eastern Hairy-tail Mole. *Parascalops breweri* (Bachman).

1844. *Scalops breweri* Bachman, Boston Journal Natural History, vol. 4, p. 32.

1895. *Parascalops breweri* True, Science (U. States) (new series), vol. 1, p. 191.

Type locality.—New England? Said (erroneously, fide Miller) by Bachman to be from Martha's Vineyard, Massachusetts.

Faunal distribution.—Canadian, transition and (rarely?) edge of upper austral zones; Gulf of St. Lawrence to western Ohio; northern New Jersey to North Carolina, in the mountains.

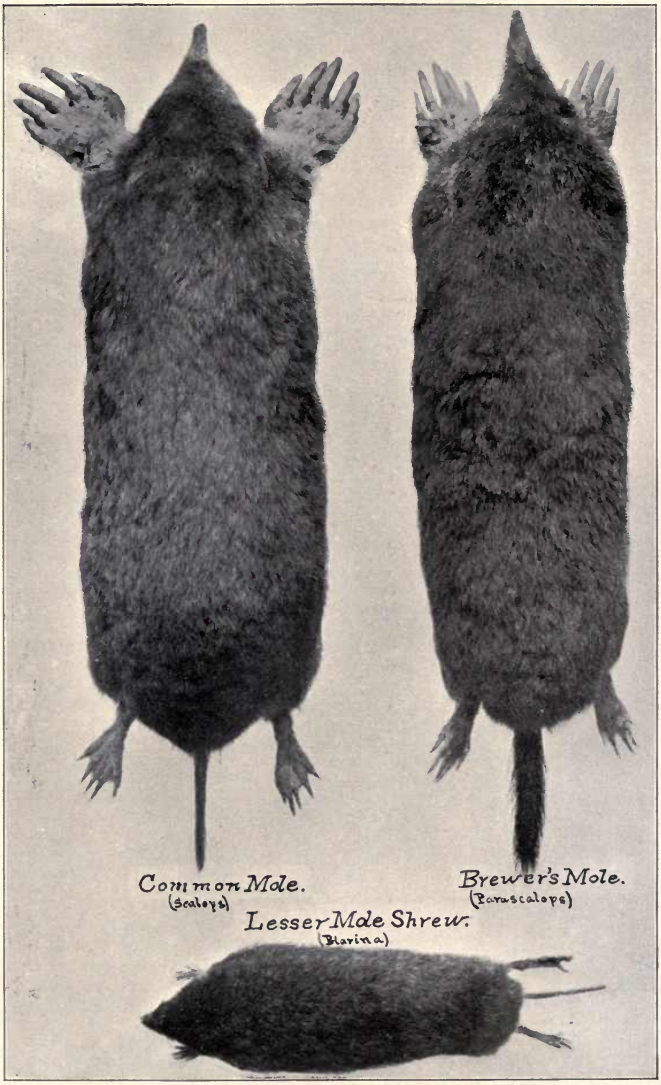
Distribution in Pa. and N. J.—Investigations carried on in Pa. since Dr. True's "Revision" of our moles show that *breweri* is the common mole of the more mountainous portions of the state and that west of the higher watershed of the Allegheny mountains, even in the lowlands, it wholly replaces *Scalops aquaticus*.

Only one N. J. specimen is known to me. The northern mountains of the state, we are morally certain, will be found to harbor it.

Records in Pa.—Allegheny Co.—Specimens from Pittsburg and Carnot in the Pittsburg Carnegie Museum.—Todd, 1901.

Beaver Co.—Specimens from Beaver, ditto.—Todd, 1901.

Butler Co.—Several specimens from Leasureville, ditto.—Todd, 1901. Three of these are in my private collection.—Rhoads, 1902.



ALL FIGURES NATURAL SIZE.

Blair Co.—"Dr. J. A. Allen mentions a specimen from Hollidaysburg which is in the Museum of Comparative Zoölogy, Cambridge, Massachusetts." —True, Revision l. c., p. 73.

Lycoming or Tioga Cos.—This species, distinguished by him from *Condylura* by its then current name, "*Talpa americana*, Black Mole," is given in R. C. Taylor's list of the animals observed by him in the "northeastern extremity of the Allegheny Mountain range in Pennsylvania."—See Loudon's Mag. N. Hist., 1835, vol. 8.

Somerset Co.—Specimen from New Lexington in Carnegie Museum, Pittsburg.—Todd, 1901.

Sullivan Co.—Mr. Behr, of Lopez, has found several specimens in that vicinity, most of which show conspicuous white markings on the head or other parts of the body. An alcoholic example recently sent by him is in the Museum of the Academy of Natural Sciences of Philadelphia.—Rhoads, 1902.

Washington Co.—I examined a specimen mounted by J. S. Nease, secured near Washington.—Rhoads, 1902.

Westmoreland Co.—A specimen was secured alive in the open country outskirts of Laughlintown, and another under a log in woodland not far from the same place, in 1878.—Rhoads.

Western Pa. in general.—My field experience and correspondence agrees with that of W. E. C. Todd, who writes: "Brewer's is the common mole of West Penna. All reported instances of *Scalops* from that region turn out to be *Parascalops*."—Rhoads, 1902.

Records in N. J.—A mounted specimen, labeled "New Jersey, Edward Harris," has long since been in the Academy of Natural Sciences of Philadelphia. Harris was a resident of Moorestown, Burlington Co., N. J. It is not likely that the specimen was taken in that county, however.—Rhoads, 1902.

General record.—The Hairy-tailed Mole "is much less abundant than the preceding [*Scalops aquaticus*], to which it bears a great resemblance. This mole seems to prefer low, wet grounds even more than the preceding species, and burrows somewhat deeper," etc.—Abbott, Geol., N. J., 1868, appx., p. 752. Regarding this statement Dr. True remarks: "No specimens are referred to, and I know of none from the state in any museum. It would seem, therefore, that the occurrence of the species in New Jersey lacks confirmation."—Revision N. American Moles, p. 73. The burden of proof in this case rests with Dr. Abbott, with the probabilities against him.—Rhoads, 1902.

Habits, etc.—I know of little that may be said to distinguish the habits of this species from that of the naked-tailed mole, except that it is often found in rather densely wooded tracts, a trait not noted in *Scalops*. It is also a tiller of the arable soils of the farmer and gardener, being often plowed out of the grounds in its haunts in western Pa., and in those regions seems as

much at home in the lowlands and the door yards and side-walks of the suburbs as does *Scalops* in the east. Its economic relations are probably identical with those of *Scalops*.

Description of species.—See comparisons under preceding species. This species is often found curiously pied or streaked with white on the head, breast, feet or tail.

Measurements.—Total length, 147 mm. ($5\frac{13}{16}$ in.); tail vertebræ, 30 ($1\frac{3}{16}$); hind foot, 19 ($\frac{3}{4}$).

Genus *Condylura* Illiger, Prodromus Systematis Mammalium et Avium, 1811, p. 125.

Star-Nose Mole; Long-tailed or Swamp Mole. *Condylura cristata* (Linnaeus).

1758. [*Sorex*] *cristatus* Linnaeus, Systema Naturae, vol. 1, p. 53.

1819. *Condylura cristata* Desmarest, Journal de Physique, vol. 89, p. 230.

Type locality.—Pennsylvania.

Faunal distribution.—Lower Hudsonian, Canadian, transition and upper austral zones; Gulf of St. Lawrence to Manitoba; southern New Jersey to N. Carolina and Tennessee, in the mountains.

Distribution in Pa. and N. J.—This species is not absent from any part of Pa., being found abundantly in the cool banks of mountain streams and in bogs and swamps, and more sparingly in the open lowlands which are perennially damp. In N. J. the same remarks apply and in the "barrens" of the southern and eastern part they exist only in the sphaguum bogs and cedar swamps.

Records in Pa.—From a mass of correspondence on the distribution of the mole in Pa., as well as from specimens examined, it would evidently be superfluous to give them in detail. The only locality where True seems not to have heard of them in Pa. is in the southwestern corner. From this region I have examined one specimen, as I now remember, sent me by J. S. Nease as having been taken near his home in Washington, Washington, Co. In Southeastern Pa. it is often found in the most austral and lowland situations along water courses and in swamps.

Records in N. J.—Specimens from the northern half of the state are numerous in collections; from the southern half I have examined them from Vincentown, Burlington Co., Haddonfield, Camden Co., and Tuckahoe, Cape May Co. I am informed by Mr. T. P. Price, of Tuckerston, that the Jillson boys have captured 2 or 3 near Tuckerton, Ocean Co.

Habits, etc.—As contrasted in habits with the other moles found in Pa. and N. J., this species may be designated as the most aquatic in its preferences.

It is, more literally, a mud and muck dweller. The other species avoid marshy and inundated grounds, and show no marked preference for the vicinity of water, but the star-nose always likes to have his nose and feet wet. In consequence of having such a "soft snap," his forefeet and legs are proportionately weaker than in either *Scalops* or *Parascalops*, and, if we may judge by its remarkable resemblance to that of the muskrat, his tail is often brought to play in swimming. I have no doubt that the anatomy of this species, as well as its chosen habitat infallibly indicates a much more aquatic life than we have yet been able to prove by actual observation. As the boggy nature of its house is distasteful to earthworms and other animals on which the upland moles subsist, we must conclude that these form but a small part of its diet, but the numerous aquatic and sub-aquatic insects and crustaceans which harbor in wet meadows and stream banks would form bountiful supply. Owing to its choice of hunting grounds the agriculturist rarely comes in contact with it, except when it gets too rampant in its digging, and muck-piling on a nice piece of meadow sod, or punches holes through the dykes and dams. Little does the farmer know, however, what is the cause of all this trouble, much less that if it were not for this self-same "pesky varmit" his meadow would soon get so "stale, unprofitable flat" and sour that his cows would abandon it. This mole has 4 to 6 young.

Description of species.—The color is a dull, blackish slate, quite different from the glossy sheen of the common mole. The tail is about half the length of head and body, and in the rutting season that of both sexes is greatly swollen, so as to resemble an elongated plummet, the base of the tail being constricted to less than ¼ the greatest diameter. The radiated disk of the nose is a conspicuous character, quite unique in the American mole family. Its office is not exactly understood, but probably enables it to discover food.

Measurements.—Total length, 170 mm. (6¾ in.); tail vertebræ, 71 (2⅞); hind foot, 27 ($1\frac{1}{16}$).

Order CHIROPTERA; Bats.

Family VESPERTILIONIDAE, Plain-nosed, web-tailed Bats.

Genus *Myotis* Kaup, Skizzirte Entw., Gesch. u Naturl. Syst. d. Europ. Thierw., 1829, vol. 1, p. 106.

Lecontes' Little Brown Bat. *Myotis lucifugus* (Leconte).

1831. *V.*[*espertilio*] *lucifugus* Leconte, McMurtrie's Cuvier's Animal Kingdom, vol. 1, p. 431.

1897. *Myotis lucifugus* Miller, North American Fauna, No. 13, p. 59.

Type locality.—Georgia. ?Near Riceboro, Liberty Co.

Faunal distribution.—North America north of Mexico, except in the Rocky Mountains and Pacific coast south of southern Alaska; viz. inhabiting the Arctic, Hudsonian, Canadian, transition and austral life zones.

Distribution in Pa. and N. J.—While this bat is to be found throughout our limits, it is apparently more numerous in the transition and Canadian life zones than in the austral.

Description of species.—Color dull, glossy brown above; beneath, on belly, paler, more yellowish; ears and wings light brown. Size small; teeth differing from those of the next species (*subulatus*) in the form of the third lower premolar. "When viewed from the side this tooth is conspicuously broader in proportion to its height in *M. subulatus*. When viewed from above the tooth is much larger in *M. subulatus* and distinctly longer than broad, while in *M. lucifugus* it is nearly as broad as long." These two species may be generically separated from other species in our limits by the following tooth formula: Incisors, $\frac{\text{up.}}{\text{low.}}\ \frac{2-2}{3-3}$; canines, $\frac{1-1}{1-1}$; premolars, $\frac{3-3}{3-3}$; molars, $\frac{3-3}{3-3}$, equaling 38 teeth in all, 20 in the lower jaw and 18 in the upper jaw. The back of the membrane between the legs is naked in this genus except at the extreme base. In *lucifugus* the ear laid forward barely reaches the end of the nose, in *subulatus* the ear reaches considerably beyond the nose. They do not differ appreciably in color nor in size.

Measurements.—(*lucifugus*) Total length, 85 mm. (3⅜ in.); tail vertebræ, 38 (1½); forearm, 38 (1½): (*subulatus*) 85 (3⅜); 38 (1½); 35 (1⅜).

Specimens examined or recorded.—Pa., from Beaver, Butler, Cambria, Clarion, Clinton, Elk, Erie, McKean and Westmoreland Cos. N. J. from Camden and Warren Cos.

Say's Little Brown Bat. *Myotis subulatus* (Say).

1823. *V.* [*espertilio*] *subulatus* Say, Long's Expedition, Rocky Mountains, vol. 2, p. 65.

1897. *Myotis subulatus* Miller, North American Fauna, No. 13, p. 75.

Type locality.—Arkansas River, near La Junta, Otero county, Colorado.

Faunal distribution.—North America; east of the Rocky Mountains; north of the Arctic zone.

Distribution in Pa. and N. J.—Occurring, or likely to occur, in all localities.

Habits, etc.—The habits of both species of small brown bat found in Pa. and N. J,, so far as they are disentangled, seem to be similar. Dr. H. Allen says they are a strictly "pastoral" as contrasted with the "urbal" kinds which infect houses and and outbuildings. They seem to congregate in caves and hollow trees, or under the bark of decayed tree trunks. Mr. Todd found

lucifugus "exceedingly abundant in a cave near Hillside, Westmoreland Co., Pa., in February, 1900, roosting in clusters containing hundreds of individuals." Dr. Abbott states that these bats "appear about the first of May in N. J., and as soon as it is dusk, commence a flight that lasts the greater part of the night, killing in the time an indescribable number of insects." The insect diet of our bats is a feature quite worthy of consideration, as they are exclusively insectivorous, so far as we know. They devour a great quantity of mosquitoes, as I have plainly observed before dark while sitting in a swarm of these pestiferous insects, the bats snapped them up within a few feet of my head. Probably nothing comes amiss which can be readily seized, but the relatively small size of the mouth of bat as compared with that of the swifts, swallows and night-hawk would confine it to small species. The finely broken elytra or wing cases of beetles can be found in their excrement. As the bat chews its food before swallowing, it is difficult to identify the contents of its stomach. The flight of the little brown bat is much more rapid than that of *Pipistrellus*, more erratic than that of the small red bat, and the animal is easily distinguished from the large brown bat by its small size. As compared with the flight of the silver-haired bat I cannot distinguish it. Most of our bats have one or rarely two young. These cling by their mouths to the teats of the mother until large enough to grasp her body. Thus laden, she pursues her nightly avocations until they can be left "hung up" in some secret place till her return. The method of alighting is first by the wing or arm hooks head upward, assisted by the hind feet. As soon as the latter are firmly implanted the bat turns head downward and hangs by the sharply recurved nails of the hind feet. Frosty weather in autumn, or such as makes insects dormant, has the same effect on all our bats in varying degrees. By this time they have become excessively fat, and in this condition go into hibernation in such places as are not subjected to very low winter temperatures, preferably caves. From these they emerge in spring with the reappearance of nocturnal insect life. Sometimes they come out duriug a February thaw, and go back again until April. The females are said to become gravid in the fall, and bring forth in the spring, an unusually long period of gestation, if true. A more or less extensive migration of some species of bat from the Canadian zone southward is supposed to occur. Especially is this the case with the genus *Lasuirus*, including the red and hoary species of our list. The voice of all our bats resembles the combination of hissing sharp squeaks and the clicking or gritting of teeth. They not only utter these when abused, but also in their encounters and gambols in the air, and when a large cluster are dislodged in a cave, these shrill, piercing cries, as they reassemble, are very disagreeable and sometimes painful to the ear.

Description of species.—See under preceding species, *M. lucifugus*.

Specimens examined or recorded.—Allegheny Co., Carnot, "A few speci-

mens received."—McKees's Rocks, 1. *Butler Co.*, Leasureville, 1.—Todd, 1902. *Crawford Co.*, Meadville, 1.—Miller, 1897.

Genus *Lasionycteris* Peters, Montsaberichte Koenig Preuss. Akad. Wissenschaften, Berlin, 1866, p. 648.

Silvery Black Bat. *Lasionycteris noctivagans* (Leconte).

1831. *V.[espertilio] noctivagans* Leconte, McMurtries' Cuvier's Animal Kingdom, vol. 1, p. 431.

1894. *Lasionycteris noctivagans* Cuvier *Supra* cit.

Type locality.—Eastern United States.

Faunal distribution.—Hudsonian, Canadian, transition and upper austral zones: Atlantic to Pacific Oceans. Rare in middle austral zone.

Distribution in Pa. and N. J.—Numerous in all parts of the country where I have collected bats, but appearing to diminish in the lowlands of southern N. J.; not nearly as abundant in Camden Co., N. J., as in Philadelphia Co., Pa., through only separated by the Delaware River. Mr. Todd, who has collected many bats in the region of Pittsburg, only reports one of this species from Westmoreland Co. Dr. Abbott says it is not common in N. J., "Have met with but few in a very large collection."—Geol. N. J.

Habits, etc.—Merriam speaks of the preference of this species to hunting food over water, skimming around like swallows. It is the earliest species of bat to appear after sunset and by far the most common bat in the Adirondack region, 63 out of 70 specimens found in a cave being *noctivagans*. The young, 1 to 2 in number, are born in early July.

Description of species.—This bat is instantly distinguished from all other of our American bats by its peculiar color, a deep black-brown, less brown than black, more or less abundantly tipped with silvery white except on the head. The dental formula for the species and genus is: incisors, $\frac{2-2}{3-3}$; canines, $\frac{1-1}{1-1}$; premolars, $\frac{2-2}{3-3}$; molars, $\frac{3-3}{3-3}$, or 36 teeth in all, 20 in the lower jaw and 16 in the upper jaw. The back of the tail membrane is hairy on the basal and naked on the terminal half.

Measurements.—Total length 100 mm. (4 in.); tail vertebræ, 40 ($1\frac{9}{16}$); forearm, 40 ($1\frac{9}{16}$).

Genus *Pipistrellus* Kaup, Skizzirte Entw. Gesch. u. Naturl. Syst. der Europ Thierw., vol. 1, p. 98.

Georgia Pigmy Bat. *Pipistrellus subflavus* (F. Cuvier).

1832. *V.[espertilio] subflavus* F. Cuvier, Nouveaux Annal. Museum d' Histoire Naturelles, Paris, vol. 1, p. 17.

1897. *Pipistrellus subflavus* Miller, North American Fauna, No. 13, p. 90.

Type locality.—Eastern United States; probably Georgia.

Faunal distribution.—Austral and lower transition zones; Atlantic Ocean to Iowa and Texas.

Distribution in Pa. and N. J.—Found abundantly in the lowlands of the southern sections. Declining in numbers northward and there intergrading into the darker race, *obscurus*, next considered.

Habits, etc.—The flight of this small bat is weak and fluttering, like that of a large butterfly, and the species may be so distinguished at sunset among the other species which then come abroad.

Description of species.—At once known by its small size (smallest of our eastern bats) and yellowish, pale color, undulated by brownish or blackish tipped hairs above. The teeth in this species and genus number 34, disposed as follows: incisors, $\frac{2-2}{3-3}$; canines, $\frac{1\ 1}{1-1}$; premolars, $\frac{2-2}{2-2}$; molars, $\frac{3-3}{3-3}$, making 18 in the lower and 16 in the upper jaw. From *obscurus* this species is separated by color alone, the northern race being duller, less yellow, and the dark tips of back hairs more conspicuous. The size of both forms is the same.

Measurements.—Total length, 85 mm. (3⅜ in.); tail vertebræ, 40 ($1\frac{9}{16}$); forearm, 35 (1⅜).

Specimens examined or reported.—Pa.—Beaver Co., Beaver, 2.—Todd, 1902, Cumberland Co., Carlisle, 7.—Miller, 1897. Delaware Co., Marple, 2.—Rhoads, 1902. Philadelphia Co., Germantown.—Stone. N. J.—Camden Co., Haddonfield, several.—Rhoads, 1902.

New York Pigmy Bat. *Pipistrellus subflavus obscurus* Miller.

1897. *Pipistrellus subflavus obscurus* Miller. North American Fauna, No. 13, p. 93.

Type locality.—Lake George, Warren County, N. York.

Faunal distribution.—Upper transition zone; Lake George to Ohio; probably to Minnesota.

Distribution in Pa. and N. J.—The only specimens known from our limits were taken by Mr. Todd in Beaver Co., Pa. He writes me it is "the common form at Beaver." See his notes published in Annals of the Carnegie Museum, vol. 1, No. 1. The five specimens alluded to were identified by G. S. Miller, Jr. This form is to be looked for in the lowlands of western and northern Pa.

Habits, description of species, etc.—See under *P. subflavus* preceding.

Genus *Eptesicus** Rafinesque, Annals of Nature, Phila., 1820, p. 2.

Northeastern Large Brown Bat; House Bat. *Eptesicus fuscus* (Beauvois).

1796. *Vespertilio fuscus* Beauvois, Catalogue Peale's Museum, Phila., p. 14.

1900. *Eptesicus fuscus* Mehely, Magyarorszag Denevereinek Monographiaja, p. 208.

Type locality.—Philadelphia, Pennsylvania.

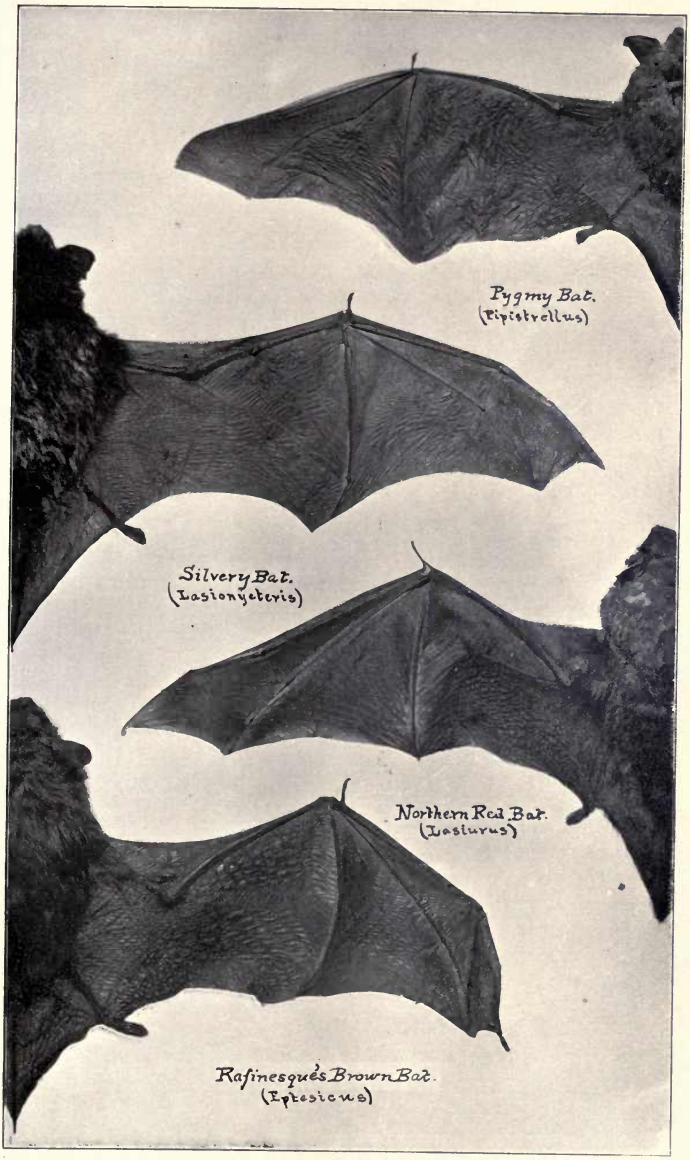
Faunal distribution.—Canadian (lower), transition and austral life zones; Maine to Washington, south to Florida and the mountains of California.

Distribution in Pa. and N. J.—With the possible exception of certain boreal tracts on the culminating ridges of the Alleghanies in Pa. the range of this abundant and familiar bat is universal in the two states.

Habits, etc.—Among American bats this species may be said to correspond in its fondness for the homes of man to the mouse and rat, or to the robin and the wren among birds. During summer they are as likely to hang up for day dreams behind an unused shutter or door, or crack in the wall, or shady porch or outhouse, as anywhere else. At night they incessantly circle about the house and lawn and street lamps until some fleeing insect suddenly leads one into the kitchen or the bedchamber and, ten-to-one, a panic ensues, resulting in no small noise, destruction of furniture and the miserable death of the innocent, harmless and useful bat. Such an occurrence as this, related by Audubon, happened in his Kentucky home in 1818 in the bed room occupied by the traveler Rafinesque. It resulted in the destruction of a favorite violin, etc., and so far as we are able to follow the sequel, in the immortality of the bat as "*Eptesicus melanops* Raf.," which, being interpreted, is no less than a synonym of *Eptesicus fuscus* (Beauvois), the subject of this article. It is interesting to note that Rafinesque, in describing the genus *Eptesicus*, says, "The name means house flyer;" and of the species *melanops* he says, "It comes often in the house at night;" recording in this way the indelible impressions of his midnight battle two years before. This bat is accused of bringing bed-bugs and other insect vermin into houses. I have never found any vermin on them except lice of a species not parasitic on man. The dirt, caused by their congregation in attics, would attract and harbor vermin, however.

Description of species.—On account of its size, being much the largest of that color in the east, our big brown bat may be separated from other eastern species solely on this basis. It is a large edition of two small brown species belonging to the genus *Myotis* previously considered. Generically it is dis-

* Mr. Miller informs me that *Eptesicus* is not generically separable from *Vespertilio*, in this agreeing with Dr. Oldfield Thomas.



ALL FIGURES NATURAL SIZE.

tinct from *Myotis*, and also from the genus *Nycticeius* (which is also represented in Pa. and N. J. by a small brown bat) in the number and arrangement of the teeth. They tabulate thus: incisors, $\frac{2-2}{3-3}$; canines, $\frac{1-1}{1-1}$; premolars, $\frac{1-1}{2-2}$; molars, $\frac{3-3}{3-3}$, making in all 32 teeth, of which 18 are in the lower and 14 in the upper jaw. In Florida and the Gulf States this species is represented by a cinnamon-hued race, *osceola;* in Mexico and the West Indies by other races; in the southwestern States by pale, desert forms.

Measurements.—Total length, 110 mm. (4⅜ in.); tail vertebræ, 45 (1¾); forearm, 45 (1¾).

Genus *Lasiurus*, Gray, Zoölogical Miscellany, 1831, No. 1, p. 38.

Northern Red Bat; Tree Bat. *Lasiurus borealis* (Müller).

1776. *Vespertilio borealis* Müller, Natursystem; Supplement, p. 21.

1877. *Lasiurus borealis* Miller, North American Fauna, No. 13, p. 105.

Type locality.—New York.

Faunal distribution,—Canadian, transition and austral zones; Ontario to the Gulf States; Atlantic Ocean to the Great Plains.

Distribution in Pa. and N. J.—Everywhere abundant and apparently resident.

Habits, etc.—Not differing essentially from those of our small bats, except that they resort largely in the day time to the foliage of trees for a resting place, either singly or in pairs. I have never seen large groups or clusters of individuals of this species as in the other kind, nor have I found them in caves, except very rarely a single one near the entrance. I have observed this species returning from apparently extensive flights over the ocean on the N. Jersey coast in the early morning before sunrise. On one or two occasions in September single individuals have been observed flying directly toward the shore, so exhausted as to make little progress against a land breeze and alighting on the nearest object as soon as land was reached. It is possible that these had been blown to sea during their migrations along the coast. The flight of this bat is remarkably direct, rapid, strong and lofty, the motion of the long, slender-pointed wings, reminding one of the swift or night hawk.

Description of species.—The color of the red bat is characteristic, separating it at a glance from all others associating with it. It is rufous red throughout, paler on the lower parts. The hairs above are tipped with gray; their bases are blackish. Some specimens are so profusely tipped with gray as to look like a different race. A marked character of the genus to which the red and hoary bats belong is the densely furred inter-femoral or tail membrane. No

doubt this serves a useful purpose as a blanket in cold weather. The tooth system is: incisors, $\frac{1-1}{3-3}$; canines, $\frac{1-1}{1-1}$; premolars, $\frac{2-2}{2-2}$; molars, $\frac{3-3}{3-3}=32$, of which 18 are in the lower and 14 in the upper jaw. A minute peg-like upper premolar is found at the base of the large canine tooth on the inner side.

From the hoary bat (*L. cinereus*) next considered, the red bat is known by being only about two-thirds the bulk of that animal, which is brownish or yellowish gray instead of red. The hoary bat is much larger than any other Pa. or N. J. bat.

Measurements.—(*borealis*), total length, 110 mm. (4¼ in.); tail vertebræ, 50 (2); forearm, 40 ($1\frac{9}{16}$). (*cinerus*), 135 (5¼); 57 ($2\frac{7}{16}$), 52 ($2\frac{1}{16}$).

Hoary Bat. *Lasiurus cinereus* (Beauvois).

1796. *Vespertilio cinereus* ("*linereus*," sic.) Beauvois, Catalogue of Peale's Museum, Phila., p. 15.

1864. *Lasiurus cinereus* H. Allen, Monograph Bats North America, p. 2.

Type locality.—Philadelphia (?), Pennsylvania.

Faunal distribution.—Miller (Monog. Vespert., N. Amer., p. 112), gives it as "Boreal North America from Atlantic to Pacific. The hoary bat breeds within the Boreal zone, but in autumn and winter it migrates south to the southern border of the United States, and probably much farther."

Distribution in Pa. and N. J.—All the instances of the capture of this bat in the two States indicate that it was either in the spring or fall migration. It may breed (reside during the summer) in the summits of the higher Alleghanies, but I have never yet seen it there. It winters in our limits.

Records in Pa.—Clinton Co.—I examined a mounted specimen in 1896, taken near Renovo, in the collection of A. K. Peirce, shot in spring of 1891. —Rhoads.

Delaware Co.—A specimen in my collection was shot near Collingdale, several years ago during a February thaw, actively flying about the borders of a wood in pursuit of insects in full daylight, cloudy sky. It was taken by Chas. Voelker, now of Aldan, same county.—Rhoads.

Philadelphia Co.—The type of *cinereus*, described from a specimen or specimens in Peale's Museum by Beauvois, was probably taken in this county. Beauvois says: "This is found in Pennsylvania." "A specimen captured near Philadelphia, was presented to the Philadelphia Museum by the late Professor Barton."—Godman, Nat. Hist., 1826, vol. 1, p. 69.

Records in N. J.—The only record for N. J. known to me is that given by Cooper in the Annals of the New York Lyceum (1837), 1848, vol. 4, p. 56, who says that the specimen from which his description of the Hoary Bat was taken "was shot by Mr. J. F. Ward in the month of November near the

heights of Weehawken [Huds. Co.], in New Jersey, near this city [New York] in broad daylight. It was hovering and fluttering about the precipice in the manner of other bats, and occasionally darting towards the low grounds, more like a bird. I have witnessed at the same locality the similar evolutions of a bat, probably of this species, that was flying about early one fine afternoon, though it kept below the shadow of the rocks."

Habits, etc.—Merriam states that this bat can be easily recognized while awing by its great size, long, pointed wings and swift, irregular flight. It covers a great extent of country in its forays after food. It did not appear in the Adirondacks on very hot summer evenings, waiting for the temperature to fall to a point below 60°. If it was 55° to 58° soon after sunset it would come out early. Its geographic distribution extends farther into the Arctic confines than that of any other species of bat. Its breeding habits are not understood. A specimen with four recently nursed teats was taken on the 30th of June. They act as if rutting in early August in the Adirondacks. The only young he ever saw was shot in early August, nearly full grown. This would indicate birth in May or June.

Description of species.—See under preceding species, *A. borealis*.

Genus *Nycticeius* Rafinesque, Journal de Physique, 1819, vol. 88, p. 417.

Rafinesque's Little Brown Bat. *Nycticeius humeralis* (Rafinesque).

1818. *Vespertilio humeralis* Rafinesque, American Monthly Magazine, vol. 3, p. 445.

1819. *N.*[*ycticeius*] *humeralis* Rafinesque, Journal de Physique, vol. 88, p. 417.

Type locality.—Kentucky.

Faunal distribution.—"Austral zones in eastern United States; west to Arkansas and southern Texas."—Miller.

Distribution in Pa. and N. J.—The only records of this bat in our limits that are known to me are the twelve specimens examined by G. S. Miller, Jr., in his "Revision" as coming from Carlisle, Pa. They are, I presume, in the National Museum, and were probably collected many years ago in a cave near Carlisle by Prof. Baird. It is strange that among the hundreds of bats which have been more recently collected in Pa. and N. J., none of this genus should have been taken, as the majority of our specimens have been secured in localities more austral than Carlisle. It must be an extremely rare species, if not absent, in the Delaware Valley. The Susquehanna Valley, connecting more directly by way of the Chesapeake, in a faunal sense, with their chosen haunts in Maryland and Virginia, seems to be the most northern record of their wanderings.

Habits, etc.—I know of no reference to the habits of this bat, nor have I ever seen it alive to distinguish it from other species of small brown bats found in the same regions.

Description of species.—In color and size not certainly distinguishable from *Myotis*, but easily separated by a look at the upper front teeth, or incisors. In Rafinesque's brown bat there is only 1 on each side, separated by a space from the large pointed fang or canine tooth. In the little brown (*Myotis*) bats these incisor teeth number 2 on each side, or 4 in all. The color of *humeralis* is "dull umber brown above, paler below, the fur everywhere plumbeous at extreme base, but the dark, basal color less well defined than in other species with which *Nycticeius* is found associated."—Miller. The teeth are distributed as follows: incisors, $\frac{1-1}{3-3}$; canines, $\frac{1-1}{1-1}$; premolars, $\frac{1-1}{2-2}$; molars, $\frac{3-3}{3-3}$ = $\frac{1\,2}{1\,3}$ = 30.

Measurements.—Total length, 90 ($3\frac{1}{2}$); tail vertebræ, 36 ($1\frac{7}{16}$); forearm, 36 ($1\frac{7}{16}$).

LIST OF FERAL (WILD) EXOTIC (IMPORTED) SPECIES FOUND IN PA. AND N. J.

Swine, "Razor Back." *Sus scrofa* Linnaeus.

Sheep. *Ovis aries* Linnaeus.

Cattle; Kine. *Bos taurus* Linnaeus.

Horse. *Equus caballus* Linnaeus.

The above 4 species of domestic animals, brought over by the early colonists to N. J., in many places were left to shift for themselves, and soon became quite as wild as the native deer with which they associated. In some instances they were liberated on the large maritime beaches or islands on the southeast coast of N. J., which formed natural confines for them throughout the year. On these they were hunted, slaughtered or captured alive as animals gone wild. The same remarks apply to the "Plains" of Burlington Co., N. J., where pig and cattle hunts were once a periodical cause of sport and excitement, and even in the last 20 years live stock has been rounded up and shot in the "Plains" as the only means of securing it. Owing to the degeneration of stock thus running wild in early days, as also on account of trespass, the early colonists framed many laws regulating these abuses. I am indebted to Mr. Francis B. Lee, of Trenton, for the following researches along this line:

"There is one phase of animal life in Colonial West Jersey which, whilst not strictly relating to the native forest beasts, forms an interesting phase in the history of state *faunas*. The island beaches which stud the coast from Cape May to Barnegat were from early days pasturage grounds for domesticated animals; which being neglected by their owners, in time became actually *feræ naturæ*. Such were the wild cattle of Avalon, Cape May county, on the beach variously known as Leaming's, Tatem's and Seven Mile, or upon the strand known as Ludlam's Beach. The owners of these beaches, branding their cattle and sheep by "ear-marks," placed the animals thereupon and their neglected descendants have only within the past decade been exterminated, as have been the buffaloes.

Aaron Leaming 2nd. of Cape May, in a manuscript record of 1771 thus alluded to the question of cattle grazing: The animals were turned on the beach from the "shore" "about the middle of October, and brought off about the middle or last of June, and live without hay or any care taken of them, and when they are not disturbed by gunners or other trespassers, do very well."

The great woodlands lying to the eastward of the Delaware river settle-

ments, such as Burlington and Salem, offered opportunities for stock raising. West Jersey early experienced conflicting rights to herbage and to animals, and commonage was claimed by the original emigrants, and indeed for several generations thereafter all domesticated animals were allowed to run at large, and so great did the nuisance become that the Assembly as early as 1683 was compelled to restrain the running at large of hogs not only as a protection to marshes and meadows, but to prevent the establishment of a custom which would lead to domesticated animals reverting to their wild state. The act of 1683 was found insufficient, as the hogs were thereafter allowed to "damnify and greatly injure ye meadows," English grass, fences and the like. To restrain which practice the Legislature in 1695 passed a "local option" hog act, relegating the entire matter to local supervision. In this connection it is interesting to note that the owners of "stone horses" or stallions were restrained by the act of 1683 from allowing their animals to range in the woods. To come within the act, the beast had to be three years old and under fourteen hands in height. The penalty for violation of this law was £5. In 1730 an act was passed to restrain small stallions from running at large between March and October, inasmuch as these animals were "very hurtful to the Breed of Horses in His Majesty's Province of *New Jersey*." In 1751 one of the last acts of the Colonial legislature was that preventing rams from running at large from August 20 to December 20, and bears many points in common with the act to restrain young stallions. The act is dated December 6, 1775.

House Mouse. *Mus musculus* Linnæus.

Norway or Barn Rat. *Mus norvegicus* Erxleben.

Black Rat. *Mus rattus* Linnæus.

The first two of these European immigrants to America need no comment, for they now abound throughout our continent, Pa. and N. J. being no exception to this rule. The black or blue rat, however, once common, and the first to appear on our shores with the earliest colonists, is said by many to be exterminated in the United States. Mr. Miller reports it as found in central Massachusetts but knows of no other place in the northeastern states where it is numerous. By careful inquiry I find it is quite numerous locally in parts of northern Pa. Some of these reports are herewith given.

Pa.—Bradford Co.—"Plentiful on farms away from railroad lines in Bradford Co."—Cleveland, 1900.

Cambria Co.—"Numerous in 1899 on farm of Jacob Kauffmann 7 miles from Johnstown. I killed 6 with a pocket rifle. They are also found on Henry Otts' farm, 15 miles south of Johnstown."—Shields, 1900.

Elk Co.—"Many in some parts of this Co. They travel to and fro."—Luhr, 1900.

Forest Co.—Not totally exterminated.—Irwin, 1900.

Lackawanna Co.—Mr. Friant recently showed me specimens taken in Scranton and vicinity where it seems not to be rare.—Rhoads, 1902.

Luzerne Co.—"I saw one Oct., 1899, along the Susquehanna near Pittston."—Campbell, 1900.

McKean Co.—"We have a number of specimens taken at Kane by A. K. Pierce."—Todd, 1902. "All through the rural districts in McKean Co. the black rat is about as common as the gray rat. Do not think I mean 'gray' when I say 'black,' for the two kinds are as easily distinguished as the black and gray squirrels."—C. W. Dickinson, 1901.

Monroe and Pike Cos.—I found this rat was predominant in the barns and houses of the backwoods in 1896, during my travels in the Pocono regions.—Rhoads, 1902.

Somerset Co.—The "blue rat" or black rat is said by farmers to abound in the parts of Somerset Co. remote from railroads.—Moore, 1901.

Sullivan Co.—"The black or 'blue' rat is still here, but not plenty."—Bennett, 1902. "I have seen none near Lopez for about 12 years."—Behr, 1901.

Tioga Co.—"Not exterminated, but rarely seen."—Cleveland, 1900.

Washington Co.—"I am 42 years old, yet never saw one in this Co. They were plenty 55 years ago."—Nease, 1900.

Wayne Co.—"I caught nearly 100 in my store and barn at Maplewood in 1898."—Stevens, 1900. Mr. Stevens gives as his experience that this rat is now (1897) confined to Lackawanna, Wayne, Pike and Monroe counties, being numerous around Maplewood, the Norway rat being there very rare. They are stated to migrate continually in colonies from place to place and to be very destructive in farm buildings.—Rhoads. Abundant in Wayne Co.—Goodnough, 1900. Scarce in Wayne Co —Teeple, 1900.

Westmoreland Co.—The only rat I saw at Laughlintown during 2 weeks collecting there in 1898, was a young black rat, now in the Carnegie Museum collection.—Rhoads.

Wyoming Co.—"None seen or heard of near Forkston in 40 years."—Robinson, 1900.

From the above accounts, it may be judged that a balance of power locally favoring the black rat as against the predominating gray species of the lowlands, is permanently established in the upper transition and Canadian life zones of Pennsylvania. I have no recent authoritative records for New Jersey, but as my inquiries in the northern parts of that state are deficient in thoroughness, I venture to predict that the black rat also holds its own in similarly favored localities in the northern section of the state.—Rhoads, 1902.

European or "Belgian" Hare. *Lepus europæus* Pallas.

This animal, escaped from domestication, has now become scattered over many localities in the northern half of New Jersey, especially in the parts radiating from Columbus, where it first spread from the estate of Pierre Lorillard, according to common report. It is now found sparingly in the wild parts of Camden and Burlington Cos., N. J., and is regularly hunted in Bucks Co., Pa., during the game season. It is the species coursed in England by greyhounds and resembles in size and actions our American Jack Rabbits, but has less extraordinary ears and relatively shorter limbs. It does not multiply rapidly, as the European or English rabbit, *Lepus cuniculus*, so that its increase in our limits may not be looked on as a serious economic problem.

Domestic Cat. *Felis domesticus* Linnæus.

In some districts this domestic animal "takes to the woods" and reverts to its feral condition. It is shot and trapped under these circumstances by hunters, and often gives rise to fabulous stories of its nature, size and rapacity.

Domestic and Indian Dog. *Canis familiaris* Linnæus.

The remarks above made regarding cats apply even more fully to the dog. These wild and often wolfish-looking dogs give rise and color to many a fake wolf story in these days, as they always have in the past.

Regarding the dog of the Pa. and N. J. Indians, found by the earliest discoverers of America, there has been much written, after it was too late to determine its relationships with the wolves and dogs of the rest of the world by an examination of specimens. But owing to its apparently hybrid characters such examination would likely prove unavailing in the main question whether the Indian dog was a dog at all, and if so, whence derived. I will leave this question by quoting from B. S. Barton's remarks in the "Medical and Physical Journal," vol. 1, part 2, 1805, pp. 1 to 31, on "Native American and Indian Dogs." After stating (1) That the Indian dogs undoubtedly existed in Pa. before the Swedes first planted their colony there, and (2) that they had pointed, upright (fide Kalm ears like those of Sweden, Barton concludes they must be a cross between the wolf and fox or wolf and some other species of dog. He says (p. 14), "This species [Indian dog] or breed is still [1805] preserved in the greatest purity among the Six Nations, from whom the Delawares acknowledge that they received it. The Delawares call this dog *Lenchum* or *Lenni-Chum* which signifies 'the original beast.'"

Dr. Daniel G. Brinton in his "*Lenape* and their Legends," says the only domesticated animal known to the New Jersey aborigines was a small species of dog with pointed ears, which animal was called *allum*. These were not

only used for protection and hunting, but likewise for food and especially for cermonial purposes.

European Red Fox. *Vulpes vulpes* (Linnæus).

For discussion of the status of the American red fox as affected by the colonial importation of the European species into our limits, when there were said to be no red foxes known in eastern Pa. and N. J., see article on *Vulpes fulvus* under our native species previously considered.

INTRODUCED NORTH AMERICAN SPECIES, PERMANENT AND FERAL IN PA. OR N. J.

Franklin's Spermophile; Gray Gopher or Ground Squirrel. *Citelleus franklini* (Sabine).

1822. *Arctomys franklini* Sabine, Transactions Linnæan Society, vol. 13, p. 587.

Type locality.—Vicinity of Cumberland House, Saskatchewan, Canada.

Faunal distribution.—Upper austral, transition, Canadian and Hudsonian zones of the Great Plains; Illinois and Lake Winnipeg to Kansas and Alberta; north to Great Slave Lake. Introduced in southern N. J.

Distribution in N. J.—Southern Burlington and Ocean Counties; said at one time to have spread from Tuckerton, their original breeding ground, to Tabernacle, Red Lion and Chatsworth in Burlington Co. Now fortuitously reported from parts of the same region, but less abundant than when first on the increase as reported by Allen and Bishop in 1877.

Habits, history, etc.—The accidental introduction and colonization of this squirrel in a region wholly remote, and differing greatly in its faunal characters from the habitat of any member of its peculiar genus, is a remarkable circumstance. It serves as a suggestive illustration of the complex problems which involve the study of the geographic distribution of animals, especially where migratory, cosmopolitan and meddlesome man has entered prominently into the local struggle for existence. The first publication of note regarding this occurrence is found in Coues' and Allen's Monograph of the N. American Rodentia, 1877, pp. 883, 884, as follows:

"This species also occurs in New Jersey, where it is rapidly increasing in numbers. I learned of its introduction there through Mr. Samuel Jillson, who first wrote me about it some three or four years since. Writing him recently about it for further information respecting the date and manner of its introduction, as well as for information respecting its present numbers and the area of its range, he has kindly replied as follows, under date of 'Tuckerton, New Jersey, May 6, 1877': 'The date of its introduction is May, 1867, when

a single pair was brought here by Mr. Sylvester Mathis from Illinois. This pair soon gnawed out of their cage and escaped. This was in the village of Tuckerton. They are now found in Manahawken, nine miles north of Tuckerton, and also four miles south of Tuckerton and very likely farther. They are very common on all the farms about here, three miles from the village [of Tuckerton]. They seem to always keep in the fields, as I have never seen them in the woods. I find very little dirt at the mouth of their burrows, sometimes none. From one to two buckets of water poured into their holes will bring them out. We kill all we can on our farm. They destroy young chickens and turkeys, and the dogs dig large holes in our fields trying to get at the Gophers. I once found one in a salt hay stack in spring, dead, coiled up in the smallest ball possible. I also found one dead in my barn well. I think many of them winter in stacks and under outbuildings, for I never could drown out any late in the fall, in the flat fields. They are never seen here in winter, and no doubt are then dormant.'"

Dr. Allen mentions another article on this subject, published by N. H. Bishop, in "Forest and Stream," Jan. 4, 1877, which covers the same ground and conjectures "whether the changed conditions will ultimately modify materially its habits and structure." To determine this and discover its distribution and abundance, I made a trip to Tuckerton in 1893, visiting the Messrs. Jillson and others in the surrounding country. This was during the fall season and the animals were hibernating. I secured no specimens except one mounted several years before by Mr. Jillson. Three or four burrows known to have been inhabited were visited without securing any. It was the general opinion that they were much diminished, though still present around Tuckerton. I found the skull of one lying near some salt hay ricks on the edge of the salt marsh. Since that date I have frequently endeavored, by the offer of 50 cents or even $1 each, to secure specimens without success. This indicates their scarcity and the difficulty of catching them, which the natives complain about.

Mr. G. H. Van Note, of Barnegat, wrote me, in 1899: "I think a few are left." Mr. T. P. Price, of Tuckerton, writes, under date of Dec., 1900: "I have twice seen them within the past year and Joseph Webb (barber) told me he saw one last 'dove season.'" Mr. James A. G. Rehn, of Philadelphia, tells me that in a recent zoölogical trip through the "Plains" of south central Burlington Co. he had conversation with a Mr. Wills, of Speedwell, regarding animals of that region. Wills told him of a squirrel, evidently of this species, which within a year or two had damaged cornfields near Eagle, 1 mile west of Speedwell, undermining the hills of corn. He had in former years captured them in cornfields near Speedwell.—Rhoads, 1902.

Description of species.—The color of typical *Spermophilus franklini* is stated by Allen to be yellowish-brown above, varied with black, the black

formed in small squarish spots; eyelids white; lower head, neck, thighs and rump pure gray, whiter on belly. Tail grayish with blackish border tipped with white; vertebræ about ½ length of head and body; hairs long, giving a bushy appearance as in a shortened red squirrel's tail. Body fur harsh and stiff. Ears small and short.*

Measurements.—Total length, 15 inches; tail vertebræ 5½ in.; hind foot, 2 in.

Canadian Beaver. *Castor canadensis* Kuhl.

The instances of wild beavers in Pa. and N. J., which are the existing descendants of animals escaped from private parks and game preserves and imported from other parts of the United States and Canada, are given in the preceding article on this species.

Eastern Prairie Cottontail; Rabbit. *Lepus floridanus mearnsi* (Allen).

It is probable, as implied by Miller and Bangs (see Proc. Boston Soc. N. History, 1895, p. 410), that this species has entered its present habitat in the mountainous parts of Pa. and N. York since the transformation of the faunal conditions of those states by deforesting. If this be true, there is a probability that this race was not found in Pa. in aboriginal times, unless there always was a strip of normally open country on the southern shores of Lake Erie. See previous remarks under this species.

? Western Timber Wolf. *Canis mexicanus* Linn. (subsp.?)

It is a fair and open question whether the "native wolves," which are stated to yet linger in the wilds of western Pa., even if eventually proved to exist there, are not from stock escaped from shows or other forms of captivity or purposely imported and released in the days of the scalp acts of 1885, etc. On this account I have placed the species in this supplemental list.

LIST OF SPECIES OF DOUBTFUL OCCURRENCE IN PA. AND N. J.

Black Killer; Square-Nosed Grampus. *Pseudorca crassidens* (Owen).

Being found on the coasts of Tasmania, Peru, Denmark and (?) Davis Strait, this rare species is considered as "pelagic" in its range. No record

* Since the above writing, Mr. A. H. Jillson has sent me two fresh skins of this spermophile, both adult females, stating, "They were killed on Oct. 10, 1902, at Tuckerton, N. J., by a boy." His measurements of total length were 14¾ in. and 16⅞ in. Mr. Bangs compared them with western skins for me and says they match exactly specimens from Minnesota and are paler than Dakota skins.

nearer to our limits than those above given has been made to my knowledge. Owing to the infrequency of capture of these savage and inaccessible tyrants of the sea, it is quite possible that the black killer has been frequently mistaken, while in its native element, for the common white-bellied species, *Oricinus arca*. It is likely to be found off the N. J. coast, and may be known by its peculiar square-nosed, lizard-like head. It is about the same size as the common killer. The roots of the teeth are round and the dorsal fin rather low and slender pointed.

Skunk Porpoise; Striped Dolphin. *Lagenorhynchus acutus* (Gray).

It is possible that some of the dolphins which Godman so graphically describes as being observed by him in the "waters" off Sandy Hook were of this species. This is emphasized by his figure of *D. dephis*, whose color pattern and shape of body and fins, without head, fit the skunk porpoise very well. The head is that of the "true dolphin," however, and so is his description. The abundance of the dolphins observed by him off Sandy Hook and the close resemblance between *L. acutus* and *D. delphis* conjointly indicate a state of affairs not now existing as to the distribution and abundance of these species.

L. acutus has been taken off the southeastern coast of Massachusetts in considerable numbers. It is, without reasonable doubt, at least a straggler to the waters of northern N. J., as are some other marine species of similar range and habits. The *Lagenorhynchus* is immediately known from *Delphinus* by its very short, broad beak. In other respects it resembles the latter, being a foot or two longer. The number of teeth in *L. acutus* is 22 to 45, in *D. delphis* 47 to 65.

Eastern Moose. *Alces americanus* Jardine.

The fossil remains of moose have been found in Pa. caves (see under fossil list). Certain statements of earliest travelers to America imply that the moose was found on the west shores of Hudson River opposite New York and in northeastern Pa. There is a Moosic in Lackawanna Co., a Moosehead in Luzerne Co., and Chinklaca-moose, the Indian Village (now Clearfield), in Clearfield Co. In Doughty's Cabinet of Natural History, vol. 1, p. 281, a Philadelphia correspondent says that the horns of moose were found in a salt lick in the Alleghany mountains, Pa., near the New York state line. These items are here noted in support of the theory that the moose in late pre-Columbian times wandered into the Alleghany mountains of Pa. from its more favored haunts in the lake regions of New York. Miller states it "once ranged throughout the state" of New York. If this can be verified by history it would be an interesting fact, at once removing any improba-

bility of its range in parts of northern Pennsylvania quite as well suited to its needs.

Western Fox Squirrel. *Scuirus rufiventer* E. Geoffroy.

The fox squirrel of the southwestern corner of Pa., once numerous, now about extinct, probably was an intergrade, nearer typical *rufiventer* than *S. l. neglectus*, the coast form. It is much more rusty than eastern Pa. specimens, if this conjecture prove correct.*

Canadian Flying Squirrel. *Scuiropterus sabrinus macrotis* Mearns.

This southern race of the large northern flying squirrel is found in the Catskill mountains, and may eventually be taken in the colder forests of the northern Pa. Alleghanies. It is distinguished from the common flying squirrel of the south by its size, being 11 inches long, 2 inches longer than *volans*. Its upper color is similar to *volans*, but the under parts are not pure white, as in that species, but a dirty white, with the hairs dark at base. I am making strenuous efforts to secure this species in Sullivan Co. through Mr. Otto Behr.

Golden Deer Mouse. *Peromyscus nuttalli* (Harlan).

This beautiful and striking species, so easily identified by its uniform golden or fulvous brown color, paler beneath, has been recorded from Pennsylvania by Prof. Baird in Mammals of N. America, p. 468. One of the specimens was a skull from Carlisle. Owing to the similarity of the skull of this species to that of *leucopus* this record cannot be relied upon. Another specimen, skin and skull, said by Coues to have the appearance of a *leucopus* skinned out of alcohol, was recorded by Baird from Falls of Schuylkill, Pa. I am unwilling to admit *P. nuttalli* to our fauna on this evidence. At the same time the species may eventually be taken as a straggler in southern York, Adams, Franklin or Lancaster Cos., as it ranges quite high in the southern Alleghanies, as far as West Virginia or perhaps Maryland.

Virginia Harvest Mouse. *Reithrodontomys leconti impiger* Bangs.

The same remarks as to possible occurrence in Pa., just given under the golden deer mouse, will almost equally apply to this tiny little dweller of the fields and brush lands of the lower austral zone. It has been found in the

* Since this writing Mr. Todd has kindly sent me a specimen of Fox squirrel taken near Industry, Beaver Co., which, in comparison with eastern Pa. skins, does not indicate any approach to the western race; in fact it is lighter than one Adams Co. specimen. It is a female, and was collected Oct. 16, 1902. Its measurements are 555–257–70.

vicinity of Washington, D. C. Being more of a lowland dweller, it may only be sought for in the lower Susquehanna valley. The Delaware Bay and Valley form a natural barrier to its dispersion in southern N. J., whose faunal conditions would be more favorable to its peculiar needs than anywhere in Pa.

Batchelder's Shrew. *Sorex macrurus* Batchelder.

Hoy's Shrew. *Sorex hoyi* Baird.

Lesueur's Shrew. *Sorex personatus lesueuri* (Duvernoy).

Fisher's Shrew. *Sorex longirostris fisheri* (Merriam).

Of these, *macrurus* and *hoyi* may be looked for in north Pa., *lesueuri* in west Pa., and *fisheri* in southern N. J. They can only be distinguished by critical and expert examination of the teeth. Hoy's shrew, however, is strikingly grayer than any other in Pa., and Batchelder's has a very long, *thick* tail as compared with the rest. They are all as small as or smaller than *personatus*, a description of which has been already given.

Big-eared Bat. *Corynorhinus macrotis* (Leconte).

The only allusions to the occurrence of this southern bat in our limits are as follows: "I am informed by Prof. Baird that specimens of a *Synous*, probably of this species, were received some years ago by the Smithsonian Institution from Meadville, Pa., but that they have become in some way misplaced and are not now to be found."—H. Allen, Monog. Bats, N. Amer., 1864, p. 64.

"On the authority of Prof. Baird it has been obtained at Meadville, in northwestern Pennsylvania. At my request, Prof. J. H. Montgomery, of Allegheny College, Meadville, recently collected a number of bats from this neighborhood, but has not succeeded in procuring *Corynorhinus*."—H. Allen, Monog. Bats N. Amer., 1893, p. 57.

While it is not impossible that a flying animal, normally found as far north as the Carolinas, might be driven by storm so far from its habitat, this record is open to doubt. Much less does it indicate the probability of its recurrence in our southern limits.

FOSSIL MAMMALS OF PENNSYLVANIA AND NEW JERSEY.

Order CHIROPTERA; Bats.

Family VESPERTILIONIDÆ; Typical Bats.

Myotis subulatus (Say). Say's Bat.

1889. *V.[espertilio] subulatus* Leidy, Ann Rep. Penn. Geol. Surv., 1887, p. 5.
Pleistocene. Hartman's Cave, near Stroudsburg, Monroe Co., Penna. These may prove to have been *M. lucifugus* Le C. See list of recent bats.

Eptesicus fuscus (Beauvois). Greater Brown Bat.

1889. *Vespertilio fuscus* Leidy, Ann. Rep. Penn. Geol. Surv., 1887, p. 5.
Pleistocene. Hartman's Cave, near Stroudsburg, Monroe Co., Penna. See also
1871.? *Vespertilio* Cope, Proc. Amer. Philos. Soc., vol. xii, p. 95.
Pleistocene. Port Kennedy, Montgomery Co., Penna. Numerous slender bones. See list of recent bats for references.

Order INSECTIVORA; Insect-eaters.

Family SORICIDÆ; Shrews.

Blarina simplicidens Cope. Fossil Mole Shrew.

1899. *Blarina simplicidens* Cope, Journ. Acad. Nat. Sci., Phila. (2), xi, pt. 2, p. 219.
Type locality.—Port Kennedy—l. c. Type No. 150, Mus. A. N. S.
Pleistocene. Port Kennedy, Montgomery Co., Penna. Left mandibular ramus.

Family TALPIDÆ; Moles.

Scalops aquaticus (Linnæus). Eastern Mole.

1889. *Scalops aquaticus* Leidy, Ann. Rep. Penn. Geol. Surv., 1887, p. 5.
Pleistocene. Hartman's Cave, near Stroudsburg, Monroe Co., Penna. See also

1871. *Scalops* sp. Cope, Proc. Amer. Philos. Soc., vol. xii, p. 94.
Pleistocene. Port Kennedy, Montgomery Co., Penna. Humerus. See list of recent moles for references.

Order FERÆ; Carnivores or Flesh Eaters.

Family URSIDÆ. Bears.

Ursus americanus Pallas. American Black Bear.

1889. *Ursus americanus* Leidy, Ann. Rep. Penn. Geol. Surv. (1887), p. 18.
Pleistocene. Durham Cave, near Riegelsville, Bucks Co., Penna.
1899. *Ursus americanus* Cope, Jour. Acad. Nat. Sci., Phila., p. 226. Port Kennedy, Montg. Co., Penna. Remains of 8 individuals. See previous list of recent bears for references.

Ursus haplodon Cope. Appalachian Cave Bear.

1871. *Arctodus pristinus* Cope (not Leidy), Proc. Amer. Philos. Soc., xii, p. 96.
1895. *Arctotherium pristinum* Cope, Proc. Acad. Nat. Sci., Phila., p. 447.
1896. *Ursus haplodon* Cope, Proc. Acad. Nat. Sci., Phila., p. 383.
Type locality.—Port Kennedy—l. c. Type No. 85, Mus. A. N. S.
Pleistocene. Port Kennedy, Montgomery Co., Penna. Remains abundant.

Family PROCYONIDÆ; Racoons, etc.

Procyon lotor (Linnæus). Eastern Racoon.

1889. *Procyon lotor* Leidy, Ann. Rep. Penna. Geol. Surv., 1887, pp. 5–18.
Pleistocene. Hartman's Cave, near Stroudsburg, Monroe Co., Penna. Durham Cave, near Riegelsville, Bucks Co., Penna. Skulls and numerous other bones. See list (*antea*), for recent Racoon references.

Family CANIDÆ; Dogs, Foxes, etc.

Canis priscolatrans Cope. Fossil Coyote.

1899. *Canis priscolatrans* Cope, Journ. Acad. Nat. Sci., Phila. (2), vol. xi, pt. 2, p. 227, pl. xviii, figs. 3 and 3 g.
Type locality.—Port Kennedy—l. c. Type No. 57, Mus. A. N. S.
Pleistocene. Port Kennedy, Montgomery Co., Penna. Various remains.

Canis mexicanus nubilus (Say). Appalachian Timber Wolf.

1889. *Canis lupus* Leidy, Ann. Rep., Penn. Geol. Surv., 1887, p. 5.

Pleistocene. Hartman's Cave, near Stroudsburg, Monroe Co., Penna. Fragments of mandible, teeth, etc. See list (*antea*), for recent wolf references.

Vulpes latidentatus Cope. Fossil Red Fox.

1899. *Vulpes latidentatus* Cope, Journ. Acad. Nat. Sci., Phila. (2), vol. xi, pt. 2, p. 228, pl. xviii, figs. 4 and 4 a.

Type locality.—Port Kennedy—l. c. Type No. 60, Mus. A. N. S.

Pleistocene. Port Kennedy, Montgomery Co., Penna. One upper molar.

Urocyon cinereoargenteus (Müller). Gray Fox.

1889. *Vulpes virginianus* Leidy, Ann. Rep., Penn. Geol. Surv., 1887, pp. 5 and 18.

1899. *Vulpes cinereoargentatus* Cope, Journ. Acad. Nat. Sci., Phila. (2), vol. xi, pt. 2, p. 228.

Pleistocene. Port Kennedy, Montgomery Co., Penna. Hartman's Cave, near Stroudsburg, Monroe Co., Penna. Durham Cave, near Riegelsville, Bucks Co., Penna. Five mandibular rami and two lower molars. See list (*antea*), for recent fox references.

Family MUSTELIDÆ; Weasels, Skunks, Otters, etc.

Mustela diluviana Cope. Fossil American Marten.

1899. *Mustela diluviana* Cope, Journ. Acad. Nat. Sci., Phila. (2), vol. xi, pt. 2, p. 229, pl. xviii, figs. 5 and 5 a.

Type locality.—Port Kennedy—l. c. Type No. 65, Mus. A. N. S.

Pleistocene. Port Kennedy, Montgomery Co., Penna. Three rami and one left inferior sectorial tooth.

Putorius noveboracensis Emmons. New York Weasel.

1889. *Putorius noveboracensis* Leidy, Ann. Rep., Penn. Geol. Surv., 1887, p. 5.

Pleistocene. Hartman's Cave, near Stroudsburg, Monroe Co., Penna. See list (*antea*), of recent weasels for references.

Gulo luscus (Linnæus). Wolverene.

1899. *Gulo luscus* Cope, Journ. Acad. Nat. Sci., Phila. (2), vol. xi, pt. 2, p. 229.

Pleistocene. Port Kennedy, Montgomery Co., Penna. Five rami and one left, superior, sectorial tooth. See list (*antea*) of recent wolverene for references.

Mephitis mephitica putida (Boitard). Northeastern Skunk.

1875. *Mephitis frontata* Coues, Bull. U. S. Geol. Surv. Terr., p. 7.

1889. *Mephitis mephitica* Leidy, Ann. Rep. Penn. Geol. Surv., 1887, pp. 5 and 18.

Pleistocene. Cave, near Carlisle, Cumberland Co., Penna. Hartman's Cave, near Stroudsburg, Monroe Co., Penna. Durham Cave, near Riegelsville, Bucks Co., Penna. See list (*antea*) for recent skunk references.

Mephitis fossidens Cope. Pitted-tooth Fossil Skunk.

1896. *Mephitis fossidens* Cope, Proc. Acad. Nat. Sci., Phila., p. 386.

Type locality.—Port Kennedy—l. c. Type, No. 69, Mus. A. N. S.

Pleistocene. Port Kennedy, Montgomery Co., Penna. Jaws of a number of individuals.

Mephitis orthostichus Cope. Intermediate Fossil Skunk.

1896. *Mephitis orthostichus* Cope, Proc. Acad. Nat. Sci., Phila., p. 389.

Type locality.—Port Kennedy—l. c. Type, No. 171, Mus. A. N. S.

Pleistocene. Port Kennedy, Montgomery Co., Penna. Rami and teeth of several individuals.

Mephitis leptops Cope. Slender-jawed Fossil Skunk.

1899. *Mephitis leptops* Cope, Journ. Acad. Nat. Sci., Phila. (2), xi, pt. ii, p. 235, pl. xviii, figs. 9 and 9 a.

Type locality. Port Kennedy—l. c. Type No. 75, Mus. A. N. S.

Pleistocene. Port Kennedy, Montgomery Co., Penna. Two mandibular rami.

Mephitis obtusatus Cope. Pigmy Fossil Skunk.

1899. *Mephitis obtusatus* Cope, Journ. Acad. Nat. Sci., Phila. (2), vol. xi, pt. ii, p. 236.

Type locality.—Port Kennedy—l. c. Type lost or mislaid by Prof. Cope.

Pleistocene. Port Kennedy, Montgomery Co. Penna. Right mandibular ramus.

1896. Genus *Osmotherium* Cope, Proc. Acad. Nat. Sci., Phila., p. 385.

Osmotherium spelæum Cope. Osmotherian Skunk.

1896. *Osmotherium spelæum* Cope, Proc. Acad. Nat. Sci., Phila., p. 385.

Type locality.—Port Kennedy—l. c. Type No. 67, Mus. A. N. S.

Pleistocene. Port Kennedy, Montg. Co., Penna. Left mandibular ramus with teeth.

1896. Genus *Pelycictis* Cope, Proc. Acad. Nat. Sci., Phila., p. 390.

Pelycictis lobulatus Cope. Great Fossil Weasel.

1896. *Pelycictis lobulatus* Cope, Proc. Acad. Nat. Sci., Phila., p. 390.

Type locality.—Port Kennedy—l. c. Type No. 66, Mus. A. N. S.

Pleistocene. Port Kennedy, Montgomery Co., Penna. Left mandibular ramus.

Lutra rhoadsii Cope. American Fossil Otter.

1896. *Lutra rhoadsii* Cope, Proc. Acad. Nat. Sci., Phila., p. 391.

Type locality.—Port Kennedy—l. c. Type No. 61, Mus. A. N. S.

Pleistocene. Port Kennedy, Montgomery Co., Penna. Portions of right and left mandibular rami with teeth.

1838. Genus *Taxidea* Waterhouse, Proceed. Zoölogical Society, London, p. 154.

Taxidea taxus (Schreber). American Badger.

1778. *Ursus taxus* Schreber, Saugthiere, vol. 3, p. 520, pl. 142 B.

1894. *Taxidea taxus* Rhoads, Amer. Nat., June, p. 254.

1899. *Taxidea americana* Cope, Journ. Acad. Nat, Sci., Phila. (2), vol. xi, pt. ii, p. 239.

Type locality.—" Labrador and around Hudson Bay."

Pleistocene. Port Kennedy, Montgomery Co., Penna. Maxillary, premaxillary bones and left mandibular ramus. This existing species was never found recent east of Lake Michigan.

Family FELIDÆ: Cats.

1833. Genus *Machairodus* Kaup, Descr. d'Ossements Foss. Mam. Mus. Darmst., pt. 2, p. 24.

Machairodus gracilis (Cope *). North American Sabre-tooth Tiger.

1880. *Smilodon gracilis* Cope, Amer. Naturalist, p. 857.

1899. *Machærodus gracilis* Cope, Journ. Acad. Nat. Sci., Phila. (2), xi, pt. ii, p. 240, pl. xx, fig. 1.

Type locality.—Port Kennedy—l. c. Type in Cope Colln. (? Amer. Mus. N. Hist., N. Y.)

* Prof. Cope's study of this species and *merceri* inclined him to the opinion that one or both would ultimately fall under *Machairodus* (see page 247 of Journal A. N. S.). He had these names greatly confused in his MSS. corrections.

Pleistocene. Port Kennedy, Montgomery Co., Penna. Various whole bones, cranial fragments and dentition of 4 individuals.

Machairodus merceri (Cope). Mercer's Sabre-tooth Tiger.

1895. *Uncia mercerii* Cope, Proc. Acad. Nat. Sci., Phila., p. 448.

1899. *Smilodon mercerii* Cope, Journ. Acad. Nat. Sci., Phila. (2), xi, pt. ii, p. 245, pl. xx, figs. 2 and 2 c.

Type locality.—Port Kennedy—l. c. Type No. 50, Mus. A. N. S.

Pleistocene. Port Kennedy, Montgomery County, Penna. Premolar teeth and two mandibular rami.

Felis inexpectatus (Cope). Fossil Puma.

1895. *Crocuta inexpectata* Cope, Proc. Acad. Nat. Sci., Phila., p. 148.

1899. *Uncia inexpectata* Cope, Journ. Acad. Nat. Sci., Phila. (2), xi, pt. ii, p. 247, pl. xxi, figs. 1–1 f.

Type locality.—Port Kennedy, l. c. Type, No. 52, Mus. A. N. S.

Pleistocene. Port Kennedy, Montgomery Co., Pa. Various bones and teeth.

Felis eyra Fischer. Eyra Cat.

1814. *Felis eyra* Fischer. Zoögnosia, vol. 3, p. 228.

1895. *Felis eyra* Cope, Proc. Acad. Nat. Sci., Phila., p. 449.

Type locality.—Paraguay.

Pleistocene. Port Kennedy, Montgomery Co., Penna. Left mandibular ramus and calcaneum. This existing species is not found north of Texas.

Lynx canadensis Kerr. Canada Lynx.

1889. *Felis canadensis* Leidy, Ann. Rep. Penn. Geol. Surv., 1887, p. 5.

Pleistocene. Hartman's Cave, near Stroudsburg, Monroe Co., Penna. Five mandibular rami, etc. See (*antea*) list of recent cats, for references.

Lynx calcaratus Cope. Fossil American Wild Cat.

1895. *Lynx rufus* Cope (not Gueldenstädt), Proc. Acad. Nat. Sci., Phila., p. 448.

1899. *Lynx calcaratus* Cope, Journ. Acad. Nat. Sci., Phila. (2), xi, pt. ii, p. 250, pl. xxi, figs. 2–2 a.

Type locality.—Port Kennedy, l. c. Type No. 56, Mus. A. N. S.

Pleistocene. Port Kennedy, Montgomery Co., Penna. Remains of a number of jaws and teeth. This species is nearly identical in size and general characters with the existing wild cat.

Order PINNIPEDIA; Seals and Walrus.

Family ROSMARIDÆ; Walruses.

1777. Genus *Rosmarus* Scopoli, Introduc. Hist. Nature, p. 490.

Rosmarus virginianus (De Kay). Fossil Atlantic Walrus.

1842. *Trichechus virginianus* De Kay, Nat. Hist. N. York, vol. 1, p. 55, pl. 19, fig. 1, a, b.

1898. *Rosmarus virginianus* Rhoads, Proc. Acad. Nat. Sci. Phila., p. 201.

Type locality.—Accomac Co., Virginia. Type destroyed by fire. Dr. Leidy describes two specimens taken on the coast of New Jersey in the Transactions of the Amer. Philosophical Society, vol. 11 (N. S.), pp. 83–86, pls. 4 and 5. One of these is in the Museum of the Academy of Natural Sciences, the other, taken at Long Branch, is in the N. Jersey State Museum in Trenton. A portion of a mandible was found in southern Chester Co. in 1900, probably found by fishermen in the Chesapeake Bay.—Rhoads, 1902.

Family PHOCIDÆ; Seals.

1875. Genus *Ogmorhinus* Peters, Montsab. K. P. Akad. Wissensch., Berlin, p. 393.

Ogmorhinus vetus (Leidy). Fossil Sea Leopard.

1854. *Stenorhynchus vetus* Leidy, Proc. Acad. Nat. Sci., Phila., vol. 6, p. 377; Cope, Geol. New Jersey, p. 740.

Type locality.—Near Burlington, N. Jersey. Type lost.

Miocene. Near Burlington, Burlington Co., New Jersey; Shiloh, Cumberland Co., New Jersey.

Order TILLODONTIA; Gliriform Ungulates.

Family TILLOTHERIDÆ.

1868. Genus *Anchippodus* Leidy, Proc. Acad. Nat. Sci., Phila., p. 232.

Anchippodus riparius Leidy, Bank Anchippode.

1868. *Anchippodus riparius* Leidy, Proc. Acad. Nat. Sci., Phila., p. 232.

Type locality.—Shark River, N. J.

Eocene. Shark River, Monmouth Co., New Jersey. Tooth.

Order UNGULATA; Hoofed Mammals.

Family ELEPHANTIDÆ; Elephants.

1799. Genus *Mammut** Blumenbach, Naturgesch., p. 698.

Mammut americanus (Kerr). Ohioan Mastodon.

1792. *Elephas americanus* Kerr, Animal Kingdom, vol. 1, p. 116.
1798. *Elephas americanus* Cuvier, Tabl. Elem. Hist. Nat., p. 149.
1799. *Mammut ohioticum* Blumenbach, Naturgesch., p. 698.
1868. *Trilophodon ohioticus* Cope, Geol. New Jersey, p. 740.
1871. *Mastodon americanus* Cope, Proc. Amer. Philos. Soc., vol. 12, p. 95 (*et auct.*).

Type locality.—Big bone lick, Kentucky.

Pleistocene. The most important records of the Mastodon in Pennsylvania and New Jersey are as follows:

Pennsylvania:

Bedford Co.—Bedford (Spgs?). See Mitchell's Appx. to Cuv. Theo. of Earth, 1818, p. 363.

Chester Co.—Michener records a tooth from White Clay Creek, near Avondale, deposited in the West Chester Academy of Science.

Franklin Co.—Near Chambersburg, a tooth. (See Phila. Med. and Phys. Jour., vol. 2, pt. 1, p. 157.)

Luzerne Co.—Pittston, remains found in association with those of *Bison*, *Equus*, etc. (See Leidy, Cont. Ext. Vert. Fauna Washn. Terr., 1873, p. 255.)

Montgomery Co.—Port Kennedy, abundant bones and teeth. (See Cope, *sup. cit.*)

?——— *Co.*—Dr. B. S. Barton, in Med. and Phys. Journal (1806), records a large tusk of a mastodon (?) found in the Chemung River, one of the branches of the Susquehanna.

New Jersey:

Bergen Co.—Corona (*fide* W. S. Valiant, Curator of Rutgers' College Museum).

Burlington Co.—(1) Near Pemberton, an almost complete skull, with ribs, leg bones, etc., of a single individual, was exposed in the bed of a small stream in 1877, and excavated by J. Coleman Saltar and Emlen McConnell. The skull is in the museum of the Acad. Nat. Sci. (See Heilprin, Proc. A. N. Sci. 1887, p. 414.) (2) Another skull is recorded from Pemberton. It

* Cuvier's name, *Mastodon*, must give place to this, the aboriginal designation. Blumenbach's "fig. 19," in his Abbildungen, fixes its identity.

was taken in a swamp, and long used as a door-step by a person ignorant of its character.

Essex Co.—Verona, a perfect tooth. (Cope, in Geol. N. J. 1868, pp. 740, 741.)

Gloucester Co.—Harrisonville, Mullica Hill and Woodbury. The first 2 localities were given me by Mr. Valiant. I record the Woodbury specimen on the authority of Dr. J. C. Currie, of that city, who states it was obtained on Mantua Creek, and is in his yard.

Mercer Co.—Near Trenton, a specimen of tusk, said to be found associated with stone implements in the Trenton gravels in 1878, 12 ft. below the surface, is in the Rutgers' College Museum.

Monmouth Co.—(1) Englishtown, in marl (fide Mr. Valiant). (2) Freehold, bones found by O. R. Wills (Cope, l. c.). (3) Hartshorne's Mills (a milk tooth) (Cope, l. c.), (4) Long Branch, skeleton standing in a marsh. (See Geol. Surv. N. York 18?, p. 4.). (5) Marlboro, mandibular ramus of young one with milk dentition. In Rutgers College Museum. (6) Poplar, in 1824, skeleton. (See Amer. Jour. Sci., vol. 11, p. 246; also Godman's N. Hist., 1826, p. 249.)

Morris Co.—(1) Boonton (fide Mr. Valiant). (2) Morris Canal, near Schooley's Mt., in 1827. (See Amer. Jour. Sci., vol. 14, p. 188.) A very large and perfect skeleton.

Salem Co.—Mannington. Probably the finest specimen of this animal now preserved in this or any other country is in the museum of Rutgers College, New Brunswick, N. Jersey. It was recently mounted by Ward, of Rochester. Very few bones were missing, these being almost exclusively tail vertebræ. Its great size and the extraordinary preservation and development of the tusks, forming a double or spiral curvature upward and outward to the length of 9 feet, render it a most unique and valuable specimen. It was excavated from a bed of gray ("recent or tertiary") marl on the "Chestnut Hill" farm, then owned by J. R. Hackett, and was embedded 6 or 8 feet below the surface. The extreme standing length from the ends of the tusks to the posterior border of the pelvis is 22 feet. To this should be added an additional length of 5 feet of tail vertebræ. The total length of the tail vertebræ, as restored by Ward, is 6½ feet. Height at shoulder 9 feet 8½ inches. Length of skull 3 feet 8 inches; its width 2 feet 10 inches.

These facts were furnished by the obliging curator, Mr. Valiant, and verified by me during a recent visit to the Museum.—Rhoads.

Sussex Co.—Near Greenville, bones dug up about 1853 (Cope l. c.).

Warren Co.—(1) Near Hope, skeleton, sent to N. York (Cope l. c.). (2) Near Vienna (tooth), on farm of J. Hance (Cope l. c.). (3) Between Vienna and Hackettstown; six skeletons in marshy bog on the farm of Wm. Ayers, under 6 feet of mud. (See Lyell's Elements of Zoölogy.)

1758. Genus *Elephas* Linnæus, Systema Naturæ, p. 33.

Elephas columbi Falconer. American Fossil Elephant.

1857. *Elephas columbi* Falconer. Quart. Jour. Geol. Soc. London, vol. 13; table facing p. 319.

1868. *Elephas primigenius* Cope. Geol. N. Jersey, p. 740.

Type locality.—Mexico and the southern United States.

Pleistocene. Cope (*sup. cit.*) records teeth of this animal from the "Gravel Drift" in N. Jersey. I have examined a molar in the Rutgers College Museum, taken near Plainfield, Union Co., N. J. Prof. S. Mitchell, in his Appx. to Cuvier's Theory of the Earth, N. York ed., 1818, p. 384, describes and figures a tooth taken near Shrewsbury, Monmouth Co., N. J.

Remains of the true fossil elephant in the eastern U. States are very rare as compared with those of the mastodon. Michener in his list of the mammals of Chester Co., Pa., records a tooth from Hockesson Valley.

Family RHINOCEROTIDÆ; Rhinoceroses.

1832. Genus *Aceratherium* Kaup, Isis, p. ?.

Aceratherium matutinum (Marsh). Appalachian Rhinoceros.

1870. *Rhinoceros matutinum* Marsh. Proc. Acad. Nat. Sci., Phila., p. 3 (nomen nudum).

1894. *Rhinoceros matutinus* Marsh. Amer. Journ. Sci. xlvi, p. 411.

1898. [*Aceratherium*] *matutinus* Trouessart. Catalogus Mammalium, p. 748.

Type locatity.—Squankum, N. J. Type in Yale Univ. Museum.

Miocene. Squankum, Monmouth Co., New Jersey. Molar.

Family TAPIRIDÆ; Tapirs.

1877. Genus *Tapiravus* Marsh. Amer. Jour. Science, p. 252.

Tapiravus validus (Marsh). Marsh's Fossil Tapir.

1871. *Lophiodon validus* Marsh, Proc. Acad. Nat. Sci., Phila., p. 9.

1877. T. [*apiravus*] *validus* Marsh, Amer. Journ. Sci., vol. xiv, p. 252.

Type locality.—Cumberland Co., N. J. Type in Yale Univ. Mus.?

Miocene. Cumberland Co., New Jersey. Molar.

1798. Genus *Tapirus* Cuvier, Tableau Element. Del. Hist. Nat., p. 152.

Tapirus haysii Leidy. Hays's Fossil Tapir.

1850. *Tapirus Americanus fossilis* Leidy, Proc. Acad. Nat. Sci., vol. iv, p. 180.

1854. *Tapirus Haysii* Leidy, Proc. Acad. Nat. Sci., Phila., vol. vi, p. 106 (*nomen nudum*).

1860. *Tapirus haysii* Leidy, in Holmes' Post-Pliocene Fossils of S. Carol., p. 107, pl. xvii, figs. 1–12.

1871. *Tapirus haysii* Cope, Proc. Amer. Philos. Soc., vol. xii, p. 95.

Type locality.—Big Bone Lick, Kentucky.

Pleistocene. Port Kennedy, Montgomery Co., Penna. Remains very abundant.

Family EQUIDÆ; Horses.

1758. Genus *Equus* Linnæus, Systema Naturæ, vol. 1, p. 73.

Equus complicatus Leidy. Complicate Fossil Horse.

1858. *Equus complicatus* Leidy, Proc. Acad. Nat. Sci., Phila., p. 11.

1860. *Equus fraternus* Leidy, in Holmes' Postpliocene Fossils of S. Carol., p. 100, pl. xv, figs. 6, 8, 16, 17, 18; pl. xvi, figs. 23, 27–29; Cope, Geol., New Jersey, p. 741; Cope, Journ. Acad. Nat. Sci., Phil., (2), xi, pt. 2, p. 255, 1899.

Type locality.—Near Natchez, Mississippi.

Pleistocene? Port Kennedy, Montgomery Co., Penna. Various bones and teeth, "Terrace deposits." Swedesboro, Gloucester Co., N. J. Pea shore clay bed in the Delaware, Camden Co., New Jersey.

1842? *Equus major* DeKay, Zoölogy of New York, Mammalia, p. 108; (*nomen nudum*); Leidy, Contr. Ext. Vert. Fauna, p. 244, 1873. "Near the Navesink Hills in New Jersey" (Monmouth Co.). (Also see teeth from Hartman's Cave, Monroe Co., Pa.) "Pittstown (Pittston) on the banks of the Susquehanna River, Luzerne Co., Penna." (with mastodon). "North branch of the Susquehanna." (Possibly a duplication of the preceding one.)

Equus pectinatus (Cope). Pectinate Fossil Horse.

1899. *Equus fraternus pectinatus* Cope, Journ. Acad. N. Sci., Phila., vol. 11, p. 255 or 6.

1901. *Equus pectinatus* Gidley, Bull. Amer. Mus. N. Hist., N. York, vol 14, p. 133.

Type locality.—Port Kennedy, Montgomery Co., Pennsylvania.

Pleistocene—Magolonyx beds. Nine superior molars and premolars.

Family SUIDÆ; Pigs.

1894. Genus *Ammodon* Marsh, Amer. Journ. Sci., vol. 46, p. 409.

Ammodon leidyanum Marsh. Leidy's Fossil Pig.

1870. *Elotherium leidyanum* Marsh, Proc. Acad. Nat. Sci., Phila., p. 3 (*Nomen nudum.*)

1894. *Ammodon Leidyanum* Marsh, Amer. Journ. Sci., vol. xlvi, p. 409, pl. ix, figs. 2 and 3.

Type locality.—Squankum, l. c. Type in Yale Univ. Mus.?

Miocene. Squankum, Monmouth Co., New Jersey. Premolar.

Family TAYASSUIDÆ; Peccaries.

1889. Genus *Mylohyus* Cope, American Naturalist, p. 134.

Mylohyus tetragonus Cope. Cope's Fossil Peccary.

1899. *Mylohyus tetrargonus* Cope, Journ. Acad. Nat. Sci., Phila., (2), xi, pt. ii, p. 260, pl. xxi, Figs. 3 and 3 b.

Type locality.—Port Kennedy, l. c. Type No. 108, Mus. A. N. S.

Pleistocene. Port Kennedy, Montgomery Co., Penna. Imperfect ramus with 6 teeth.

Mylohyus pennsylvanicus (Leidy). Pennsylvania Fossil Peccary.

1889. *Dicotyles pennsylvanicus* Leidy, Ann. Rep. Penn. Geol. Surv., 1887, p. 8, pl. ii, figs. 3–6.

1893. *Mylohyus pennsylvanicus* Cope, Publica. Univ. of Penna., vol. 6, p. 171.

1899. Journ. Acad. Nat. Sci., Phila., (2), vol. xi, pt. ii, p. 262.

Type locality.—Hartman's Cave, l. c. Type in Mus. A. N. S.

Pleistocene. Hartman's Cave, near Stroudsburg, Monroe Co., Penna. Durham Cave, near Reigelsville, Bucks Co., Penna. Irwin's Cave, Port Kennedy, Montgomery Co., Penna. Jaws and teeth.

Mylohyus nasutus (Leidy). Long-Snouted Fossil Peccary.

1869. *Dicotyles nasutus* Leidy. Extinct Mammals Dak. and Neb., p. 385, pl. xxviii, figs. 1 and 2.

1899. *Mylohyus nasutus* Cope, Journ. Acad. Nat. Sci., Phila. (2), xi, pt. ii, p. 263.

Type locality.—Gibson Co., Indiana.

Pleistocene. Port Kennedy, Montgomery Co., Penna. Superior Canine.

Eocene. Shark River, Monmouth Co., New Jersey. Molar.

Miocene. Squankum, Monmouth Co., New Jersey.

1875. Genus *Thinohyus* Marsh, Amer. Jour. Sci., vol. ix, p. 248.

Thinohyus antiquus (Marsh). Marsh's Fossil Peccary.

1870. *Dicotyles antiquus* Marsh, Proc. Acad. Nat. Sci., Phila., p. 11. (*nomen nudum.*)

1894. *Perchœrus* (*Dicotyles*) *antiquus* Marsh, Amer. Journ. Sci., vol. xlvi, p. 411, pl. x, fig. 1.

1894. *Thinohyus* (*Dicotyles*) *antiquus* Marsh, Amer. Journ. Sci., vol. xlviii, p. 271.

Type locality.—Shark River—l. c. Type in Mus. Yale Univ.

Miocene. Shark River, Monmouth Co., New Jersey. Molar.

1848. Genus *Platigonus* Le Conte, Amer. Jour. Sci., vol. V, p. 103.

Platigonus vetus Leidy. Leidy's Platygone Peccary.

1883. *Platygonus vetus* Leidy, Proc. Acad. Nat. Sci., Phila., p. 301.

Type locality.—Mifflin Co., Penna. Type in Mus. A. N. S.

Limestone Quarry, Mifflin Co., Penna. Fragments of jaws with teeth.

Family BOVIDÆ; Oxen and Bisons.

Bison bison (Linnæus). American Bison.

1873. *Bison latifrons* Leidy, Cont. Ext. V. Fauna, Wash. Ter., p. 255, pl. xxviii.

1889. *B*[*ison*] *americanus* Leidy, Ann. Rep. Penn. Geol. Surv., 1887, p. 5.

Pleistocene? Hartman's Cave, near Stroudsburg, Monroe Co., Penna., jaw fragment with last molar. Pittston, Luzerne Co., second upper and first and third lower molars (recent?). Specimens in Mus. A. N. Sci., Phila. See list (*antea*) for recent bison references.

Bison, sp. (Cope.)

1871. *Bos* Cope, Proc. Amer. Philos. Soc., xii, p. 96.

Pleistocene. Port Kennedy, Montgomery Co., Penna. Various bones.

1816. Genus *Ovibos* Blainville; Bulletin Soc. Philomatique, p. 76.

Ovibos (Bootherium) appalachicolus (Rhoads). Appalachian Musk Ox.

1895. *Bison appalachicolus* Rhoads, Proc. Acad. Nat. Sci., Phila., p. 248.

1897. *Ovibos* (*Boötherium?*) *appalachicolus* Rhoads, Proc. Acad. Nat. Sci., Phila., p. 492.

Type locality.—Durham Cave—l. c. Type No. 29, Mus. A. N. S.

Pleistocene. Durham Cave, near Riegelsville, Bucks Co., Penna. Horn core.

Ovibos moschatus (Zimmermann). Musk Ox.

1780. *Bos moschatus* Zimmermann, Geographisch. Geschichte, vol. ii, p. 86.

1822. *Ovibos moschatus* Desmarest, Mammalogie, vol. ii, p. 492.

Type locality.—Churchill River, Keewatin, Canada. Prof. F. W. Putnam writes as follows regarding a specimen of this animal which I was informed by Dr. C. C. Abbott had been found near Trenton, N. J. "We have in the American Museum of Natural History, New York, a fragment of the scapula of a musk ox found on March 13, 1899, while digging sand underlying the Trenton gravel at the place known as the sand pit on Hancock Street. The specimen was found ten feet below the present surface."

Family CERVIDÆ; Deer.

1899. Genus *Teleopternus* Cope, Jour. Acad. Nat. Sci., Phila., p. 263.

Teleopternus orientalis Cope. Cope's Cameloid Deer.

1899. *Teleopternus orientalis* Cope. Journ. Acad. Nat. Sci., Phila., (2), vol. xi, pt. ii, p. 264, pl. xxi, figs. 4 and 4a.

Type locality.—Port Kennedy, l. c. Type No. 39, Mus. A. N. S.

Pleistocene. Port Kennedy, Montgomery Co., Penna. Molar teeth of three individuals.

1835. Genus *Alces* Jardine, Naturalist's Library, 21, p. 125.

Alces americanus Jardine. East American Moose.

1835. *Alces americanus* Jardine, Naturalist's Library, vol. 21, p. 125.

1889. *Alce americanus* Leidy, Ann. Rep., Penn. Geol. Survey, p. 19.

Type locality.—Eastern Canada.

Pleistocene. Durham Cave, near Reigelsville, Bucks Co., Penna. In Doughty's Cab. Nat. Hist., vol. 1, p. 281, a Phila. correspondent says horns of moose were found in a salt lick in the Allegheny Mountains, Pa., near the New York State line.

1885. Genus *Cervalces* Scott, Proc. Acad. Nat. Sci., Phila., p. 184.

Cervalces scotti (Lydekker), Scott's Fossil Moose.

1825. *Cervus americanus* Harlan (not of Erxleben). Fauna americana, p. 245.

1885. *Cervalces americanus* Scott, Proc. Acad. Nat. Sci., Phila., p. 184.

1898. *Alces scotti* Lydekker, Deer of all Lands, p. 60.

Type locality.—Mt. Hermon, l. c. Type mounted in Mus. Princeton Univ., N. J.

Pleistocene. Shell marl beneath a bog. Mt. Hermon, Warren Co., New Jersey. Skeleton.

827. Genus *Rangifer* Ham. Smith, Griffith's Cuv. Animal Kingdom, vol. 5, p. 304.

Rangifer caribou (Gmelin). Woodland Caribou.

1788. [*Cervus tarandus*], var. C., *caribou* Gmelin, Linn. Sys. Naturæ, p. 177.

1889. *Rangifer caribou* Leidy, Ann. Rep. Penn. Geol. Surv., 1887, p. 5.

Type locality.—Eastern Canada. "New France" of Charlevoix.

Pleistocene. Hartman's Cave, near Stroudsburg, Monroe Co., Penna. Jaw fragments and teeth.

Rangifer grœnlandicus (Gmelin). Barren Ground Caribou.

1788. [*Cervus tarandus*] var. B, *grœnlandicus* Gmelin, Linn. Syst. Naturæ, p. 177.

1868. *Rangifer grœnlandicus* Cope, Geol. New Jersey, p. 740.

1869. *Cervus tarandus* Leidy, Ext. Mamm., N. America, p. 377.

Type locality.—Greenland.

Drift Period. Gravel, New Jersey. An antler from Trenton, N. J., in Peabody Museum, Mass., *fide* Putnam, 1901. Vincentown, Burlington Co., New Jersey.

Cervus canadensis Erxleben. Wapiti; American Elk.

1868. *Cervus canadensis* Cope, Geol. New Jersey, p. 742; Leidy, Ext. Mamm., N. Amer., p. 377, 1869.

1889. *Cervus canadensis* Leidy, Ann. Rep. Penn. Geol. Surv., 1887, pp. 6 and 19.

Pleistocene. Hartman's Cave, near Stroudsburg, Monroe Co., Penna.; Durham Cave, Bucks Co., Penn. Fragments of bones and teeth. Gravel Drifts, New Jersey. Deal, Monmouth Co., New Jersey. Portions of antlers. See list (*antea*) for recent wapiti references.

Odocoileus americanus (Erxleben). Virginia Deer.

1868. *Cariacus virginianus* Cope, Geol., New Jersey, p. 742.

1869. *Cervus virginianus* Leidy, Ext. Mamm. N. Amer., p. 376; also 1889, Annual Rep. Penn. Geol. Surv., 1887, pp. 6 and 19.

Pleistocene. Hartman's Cave, near Stroudsburg, Monroe Co., Penna. Durham Cave, near Reigelsville, Bucks Co., Penna. Numerous bones and teeth. Carlisle, Cumberland Co., Penna. "Marl pits and superficial drift," New Jersey. Burlington and Monmouth counties, New Jersey. See list (*antea*) for recent deer references.

Odocoileus Sp. (Cope).

1899. *Cariacus* sp., Cope, Journ. Acad. Nat. Sci., Phila., (2), vol. xi, pt. ii, p. 266.

Pleistocene. Port Kennedy, Montgomery Co., Penna. Various bones and portions of the same, considered by Prof. Cope to be referable probably to the Virginia deer, *O. americanus* (*supra*).

Odocoileus lævicornis (Cope). Slender Horned Fossil Deer.

1896. *Cariacus lævicornis* Cope, Proc. Acad. Nat. Sci., Phila., p. 393.

Type locality.—Port Kennedy, l. c., Type No. 41, Mus. A. N. S.

Pleistocene. Port Kennedy, Montgomery Co., Penna. Right superior molars, various bones and portions of base of antlers.

Order GLIRES: Rodents or Gnawers.

Family ERETHIZONTIDÆ; Non-prehensile Porcupines.

Erethizon dorsatus (Linnæus). Appalachian Porcupine.

1871. *Erethizon cloacinum* Cope, Proc. Amer. Philos. Soc., vol. xii, p. 93.

1889. *Erethizon dorsatus* Leidy, Ann. Rep. Penn. Geol. Surv., 1887, pp. 5 and 18.

1899. *Erethizon? dorsatum* Cope, Jour. Acad. Nat. Sci., Phila., (2), vol. xi, pt. ii, p. 198.

Pleistocene. Port Kennedy, Montgomery Co., Penna. Several molars. Hartman's Cave, near Stroudsburg, Monroe Co., Penna. Durham Cave, near Reigelsville, Bucks Co., Penna. Parts of skulls and numerous bones and teeth. See list (*antea*) for references to recent porcupines.

Family SCIURIDÆ; Squirrels.

Sciurus carolinensis Gmelin. Carolina Gray Squirrel.

1889. *Sciurus carolinensis* Leidy, Ann. Rep. Penn. Geol. Surv., 1887, pp. 5 and 18.

Pleistocene. Hartman's Cave, near Stroudsburg, Monroe Co., Penna., and Durham Cave, near Reigelsville, Bucks Co., Penna. Bones and teeth. See list (*antea*) for references to recent squirrels.

Sciurus calycinus Cope. Cope's Fossil Chickaree.

1871. *Sciurus calycinus* Cope, Proc. Amer. Philos. Soc., vol. xii, p. 86.

Type locality.—Port Kennedy, l. c. Type probably in Amer. Mus., N. Hist. of N. York.

Pleistocene. Port Kennedy, Montgomery Co., Penna. Two imperfect rami with molars.

Tamias striatus (Linnæus). Eastern Chipmunk.

1889. *Tamias striatus* Leidy, Ann. Rep. Penn. Geol. Surv., 1887, p. 6.

Pleistocene. Hartman's Cave, near Stroudsburg, Monroe Co., Penna. Ten mandibular rami, etc. See list (*antea*) for references to recent chipmunk.

Arctomys monax (Linnæus). Maryland Marmot, Woodchuck.

1889. *Arctomys monax* Leidy, Ann. Rep. Penn. Geol. Surv., 1887, pp. 5 and 18.

Pleistocene. Hartman's Cave, near Stroudsburg, Monroe Co., and Durham Cave, near Riegelsville, Bucks Co., Penna. Skulls and various bones. See list (*antea*) for references to recent marmot.

Family CASTORIDÆ; Beavers.

Castor canadensis Kuhl. American Beaver.

1889. *Castor fiber* Leidy (not of Linn.), Ann. Rep. Penn. Geol. Surv, 1887, pp. 5 and 18; Cope (not of Linn.), Proc. Acad. Nat. Sci., Phila., p. 378, 1896.

Pleistocene. Port Kennedy, Montgomery Co., Penna. Left mandibular ramus and three superior molars. Hartman's Cave, near Stroudsburg, Monroe Co., and Durham Cave, near Riegelsville, Bucks Co., Penna. Various bones. "Portions of skull and jaws with teeth found together with remains of the Mastodon in marshes in New Jersey." (Leidy in Holmes' Post Pleiocene Fossils of S. Carol., p. 112.) See list (*antea*) for references to recent beaver.

Family MURIDÆ; Mice, Rats, etc.

Peromyscus leucopus (Rafinesque). Rafinesque's Deer Mouse.

1889. *Hesperomys leucopus* Leidy, Ann. Rep. Penn. Geol. Surv., 1887, p. 6.

Pleistocene. Hartman's Cave, near Stroudsburg, Monroe Co., Penna. One mandibular ramus, etc.

Peromyscus sp.—(Cope).

1871. *Hesperomys* sp., Cope, Proc. Amer. Philos. Soc., xii, p. 87.

1897 (*Peromyscus*). Pub. Univ. of Penna., vol. 6, p. 170. (Mercer).

Pleistocene. Port Kennedy, Montgomery Co., Penna. Durham Cave, Bucks Co., Penna. Rami with teeth; various bones. See list (*antea*) of recent *Peromyscus*.

Neotoma magister Baird. Allegheny Cave Rat.

1857. *Neotoma magister* Baird. Mamm. N. Amer., p. 498.

1889. *Neotoma floridana* Leidy (not Say and Ord), Ann. Rep. Penn. Geol. Surv., 1887, pp. 6 and 19.

"Bone caves of Pennsylvania" (near Carlisle). Baird.

Pleistocene. Hartman's Cave, near Stroudsburg, Monroe Co., Penna.

Numerous bones. Durham Cave, near Riegelsville, Bucks Co., Penna. See list (*antea*) of recent *Neotoma*.

1881. Genus *Anaptogonia* Cope, Proc. Amer. Philos. Soc., p. 91.

Anaptogonia hiatidens (Cope). Great Anaptogon Vole.

1871. *Arvicola hiatidens* Cope, Proc. Amer. Philos. Soc., xii, p. 91.

1896. *Anaptogonia hiatidens* Cope, Proc. Acad. Nat. Sci., Phila., p. 379.

Type locality.—Port Kennedy, l. c. Type in Amer. Mus. Nat. Hist., N. York.?

Pleistocene. Port Kennedy, Montgomery Co., Penna. Lower molars. This vole is twice the size of the meadow mouse.

1899. Genus *Sycium* Cope, Jour. Acad. Nat. Sci., Phila., vol. xi, pt. 2, p. 203.

Sycium cloacinum (Cope). Cope's Sycium Vole.

1896. *Anaptogonia cloacina* Cope, Proc. Acad. Nat. Sci., Phila., p. 380.

1899. *Sycium cloacinum* Cope, Journ. Acad. Nat. Sci., Phila. (2), vol. xi, pt. ii, p. 203.

Type locality.—Port Kennedy, l. c. Type No. 147, Mus. A. N. S.

Pleistocene. Port Kennedy, Montgomery County, Penna. Molars (4) of 2 individuals. Size about the same as *A. hiatidens, supra.*

Microtus pennsylvanicus (Ord). Wilson's Meadow Vole.

1889. *Arvicola riparius* Leidy, Ann. Rep. Penn. Geol. Surv., 1887, p. 6.

Pleistocene. Hartman's Cave, near Stroudsburg, Monroe Co., Penna. Two mandibular rami, etc. See list (*antea*) for reference to recent *Microtus*.

Microtus diluvianus Cope. Great Diluvian Vole.

1896. *Microtus diluvianus* Cope, Proc. Acad. Nat. Sci., Phila., p. 381.

Type locality.—Port Kennedy, l. c. Type No. 144, Mus. A. N. S.

Pleistocene. Port Kennedy, Montgomery Co., Penna. Molars. This vole is apparently larger than any existing *Microtus*.

Microtus speothen (Cope). Isodeltan Fossil Vole.

1871. *Arvicola speothen* Cope, Proc. Amer. Philos. Soc., vol. xii, p. 87, fig. 13.

1871. *Arvicola tetradelta* Cope, Proc. Amer. Philos. Soc., vol. xii, p. 88, fig. 14.

1896. *Microtus speothen* Cope, Proc. Acad. Nat. Sci., Phila., p. 383.

Type locality.—Port Kennedy, l. c. Type in Amer. Mus. N. Hist., N. Y.?

Pleistocene. Port Kennedy, Montgomery Co., Penna. Left mandibular ramus.

Microtus dideltus (Cope). Fossil Pine Vole.

1871. *Arvicola didelta* Cope, Proc. Amer. Philos. Soc., vol. xii, p. 89, fig. 15.

1871. *Arvicola sigmodus* Cope, Proc. Amer. Philos. Soc., vol. xii, p. 90, fig. 17.

1899. *Microtus dideltus* Cope, Journ. Acad. Nat. Sci., Phila. (2), vol. xi, pt. ii, p. 207.

Type locality.—Port Kennedy, l. c. Type in Amer. Mus. Nat. Hist., N. Y.?

Pleistocene. Port Kennedy, Montgomery Co., Penna. Mandibular rami and superior dentition. This vole is so closely related to the existing *M. pinetorum* as to suggest their identity.

Microtus involutus (Cope). Involute Fossil Vole.

1871. *Arvicola involuta* Cope, Proc. Amer. Philos. Soc., xii, p. 89, fig. 16.

1896. *M.*[*icrotus*] *involutus* Cope, Proc. Acad. Nat. Sci., Phila., p. 382.

Type locality.—Port Kennedy, l. c. Type in Amer. Mus. N. Hist., N. York.?

Pleistocene. Port Kennedy, Montgomery County, Penn. Mandibular ramus with full series of teeth.

Fiber zibethicus (Linnæus). Eastern Muskrat.

1869. *Fiber zibethicus* Leidy, Extinct Mamm. N. Amer, p. 406; Ann. Rep. Penn. Geol. Surv., 1887, pp. 5 and 19, 1889.

Pleistocene. Hartman's Cave, near Stroudsburg, Monroe Co., Penna. Various bones and teeth. Durham Cave, near Riegelsville, Bucks Co., Penna. "Associated with Mastodon remains in New Jersey." See list (*antea*) of references to recent muskrat.

Family ZAPODIDÆ; American Jumping Mice.

1873. Genus *Zapus* Coues, Bul. U. S. Geolog. Surv., No. 5, ser. 2, p. 253.

Zapus hudsonius (Zimmermann). Eastern Meadow Zapus.

1871. *Jaculus? hudsonius* Cope, Proc. Amer. Philos. Soc., xii, p. 86.

Pleistocene. Port Kennedy, Montgomery Co., Penna. One mandibular ramus. See list (*antea*) for references to recent *Zapus*.

Family CASTOROIDIDÆ; Giant Beavers.

1838. Genus *Castoroides* Foster, Second Report Geol. Surv. Ohio, p. 81.

Castoroides ohioensis Foster. Great Fossil Beaver.

1838. *Castoroides ohioensis* Foster, Second Ann. Rep. Geol. Surv. Ohio, p. 81.

1889. *Castoroides ohioensis* Leidy, Ann. Rep. Penn. Geol. Surv., 1887, p. 14.
Type locality.—Near Nashport, Muskingum ("Licking") Co., Ohio.
Pleistocene. Hartman's Cave, near Stroudsburg, Monroe Co., Penna. Incisors and molar teeth. Also recorded by S. Lockwood in Hist. of Monmouth Co., N. J., as having been found there.

Family OCHOTONIDÆ; Pikas.

1795. Genus *Ochotona* Link.

Ochotona palatinus (Cope). Cope's Fossil Pika.

1871. *Praotherium palatinum* Cope, Proc. Amer. Philos. Soc., xii, p. 94, fig. 20.
1899. *Logomys palatinus* Cope, Journ. Acad. Nat. Sci., Phila., (2), xi, pt. ii, p. 209.
Pleistocene. Port Kennedy, Montgomery Co., Penna. Palatal region of one individual with four molars.

Family LEPORIDÆ; Hares.

Lepus floridanus mallurus (Thomas). Eastern Cottontail Rabbit.

1871. *Lepus sylvaticus* Cope, Proc. Amer. Philos. Soc., vol. xii, p. 93; Leidy, Ann. Rep. Penn. Geol. Surv., 1887, pp. 6 and 19, 1889.
Pleistocene. Port Kennedy, Montgomery Co., Penna. Remains of numerous individuals. Hartman's Cave, near Stroudsburg, Monroe Co., Penna. Various bones and teeth. Durham Cave, near Riegelsville, Bucks Co., Penna.

Order SIRENIA: Manatees, Dugongs, etc.

Family TRICHECHIDÆ; Manatees.

1758. Genus *Trichecus* Linnæus, Systema Naturæ, vol. i, p. 34.

Trichecus sp. (Leidy).

1869. *Manatus* sp. Leidy, Extinct Mamm. N. America, p. 414.
"Miocene and later formations of New Jersey."

Family DUGONGIDÆ; Dugongs.

1871. Genus *Hemicaulodon* Cope, Proc. Amer. Philos. Soc., vol. xi, p. 191.

Hemicaulodon effodiens Cope. Great Extinct Dugong.

1871. *Hemicaulodon effodiens* Cope, Proc. Amer. Philos. Soc., vol. xi, p. 191, pl. 5, fig. 6.

Type locality.—Shark River, l. c. Type may be in Amer. Mus. Nat. Hist., N. York.

Eocene. Shark River, Monmouth Co., New Jersey. Incisor.

Order CETACEA: Whales, Dolphins.

Family SQUALODONTIDÆ: Shark-toothed Whales.

1840. Genes *Squalodon* Grateloup, Act. Acad. Roy. Sci., Bourdeaux, p. 208.

Squalodon atlanticus (Leidy). Biserrate Squalodon.

1856. *Macrophoca atlanticus* Leidy, Proc. Acad. Nat. Sci., Phila., p. 220.
1867. *Squalodon atlanticus* Cope, Proc. Acad. Nat. Sci., Phila., p. 132.
Type locality.—Shiloh, l. c. Whereabouts of type not known.
Miocene. Shiloh, Cumberland Co., New Jersey. Molars.

Squalodon sp., Cope.

1868. *Squalodon* sp., Cope, Geol. New Jersey, p. 740.
Miocene. Squankum, Monmouth Co., New Jersey.

Family PLATANISTIDÆ; Little-necked Whales.

1869. Genus *Priscodelphinus* Leidy, Proc. Acad. Nat. Sci., Phila., p. 326.

Priscodelphinus harlani, Leidy. Harlan's Sword Dolphin.

1851. *Priscodelphinus harlani*, Leidy, Proc. Acad. Nat. Sci., Phila., p. 327.
1851. *Priscodelphinus grandævus* Leidy, Proc. Acad. Nat. Sci., Phila., p. 327 (three lines lower).
Type locality.—"Greensand of N. Jersey." Leidy, l. c. Type in Mus. A. N. S.
Miocene. Mullica Hill, Gloucester Co., New Jersey. Shiloh, Cumberland Co., New Jersey. Vertebræ.

Priscodelphinus lacertosus (Cope). Lacertine Sword Dolphin.

1868. *Delphinapterus lacertosus*, Cope, Proc. Acad. Nat. Sci., Phila., p. 190 (above).
1868. *Delphinapterus hawkinsii* Cope, Proc. Acad. Nat. Sci., Phila., p. 190 (below).
Type locality.—Shiloh, l. c. Type may be in Amer. Mus. N. Hist., N. York.
Miocene. Cumberland Co., N. Jersey.

Priscodelphinus uraeus (Cope). Urean Sword Dolphin.

1869. *Tretophys uraeus* Cope, Proc. Acad. Nat. Sci., Phila., p. 8.

? 1871. *Priscodelphinus lacertosus* Cope, Proc. Amer. Philos. Soc., p. 363.
1876. *Priscodelphinus uraeus* Cope, Proc. Amer. Philos. Soc., p. 363.
Type locality.—Shiloh, l. c. Type may be in A. M. N. H., N. York.
Miocene. Shiloh, l. c. Vertebra.

1868. Genus *Ixacanthus* Cope, Proc. Acad. Nat. Sci., Phila., p. 159.

Ixacanthus coelospondylus Cope. Ixacanth Sword Dolphin.

1868. *Ixacanthus coelospondylus* Cope (same reference as for genus): Geology N. Jersey, p. 739.
Type locality.—Maryland.
Miocene. Shiloh, Cumberland Co., N. Jersey. Cope states that the presence of this species in the New Jersey Miocene is doubtful. Proc. Amer. Philos. Soc., vol. xi, p. 364.

1868. Genus *Zarachis* Cope, Proc. Acad. Nat. Sci., Phila., p. 189.

Zarhachis velox Cope. Slender Zarachian Whale.

1869. *Zarhachis velox* Cope, Proc. Acad. Nat. Sci., Phila., p. 10.
Type locality.—Shiloh, l. c. Type may be in Amer. Mus. Nat. Hist., N. York.
Miocene. Shiloh, Cumberland Co., New Jersey. A single vertebra.

1875. Genus *Agabelus* Cope, Proc. Amer. Philos. Soc., p. 363.

Agabelus porcatus Cope. Porcate Sword Dolphin.

1875. *Agabelus porcatus* Cope, Proc. Amer. Philos. Soc., vol. xiv, p. 363.
Type locality.—Cumberland Co., l. c. Type may be in Amer. Mus. N. Hist., N. Y.
Miocene. Cumberland Co., New Jersey. Muzzle.

Family PHYSETERIDÆ; Sperm Whales.

1758. Genus *Physeter* Linnæus, Systema Naturæ, vol. 1, p. 76.

Physeter vetus (Leidy). Leidy's Sperm Whale.

1853. *Physeter antiquus* Leidy (not Gervais), Proc. Acad. Nat. Sci., Phila., p. 378; Cope, Geol. New Jersey, p. 739.
1869. *Catodon vetus* Leidy, Extinct Mamm. N. Amer., p. 436.
1898. [*Physeter*] *antiquus-vetus* Trouessart, Catal. Mamm., p. 1055.
Type locality.—Ashley River, S. Carolina.
Miocene. Shiloh, Cumberland Co., New Jersey.

Order EDENTATA; Anteaters, Sloths, etc.

Family MYLODONTIDÆ; Colpodont Ground Sloths.

1840. Genus *Mylodon* Owen, Zoöl. Beagle, p. 67.

Mylodon missouriensis (Harlan). Harlan's Ground Sloth.

1841. *Oryctotherium missouriense* Harlan, Proc. Amer. Philos. Soc., vol. 2, p. 311.

1842. *Mylodon harlani* Owen, Descr. Ext. Gig. Sloth, p. 15.

1871. *Mylodon ? harlani* Cope, Proc. Amer. Philos. Soc., xii, p. 85.

Type locality.—Benton Co., Missouri.

Pleistocene. Port Kennedy, Montgomery Co., Penna. Ungual phalanges and portion of tibia.

Family MEGALONICHIDÆ; Diastemodont Ground Sloths.

1797? Genus *Megalonyx*. Jefferson, Trans. Amer. Philosoph. Soc., Phila., vol. 4, 1798 [1797?], p. 248.

Megalonyx loxodon Cope. Loxodont Ground Sloth.

1871. *Megalonyx loxodon* Cope, Proc. Amer. Philos. Soc., xii, p. 74, fig. 2.

Type locality.—Port Kennedy, l. c. Type in Amer. Mus. N. Hist., N. Y.?

Pleistocene. Port Kennedy, Montgomery Co., Penna. Single superior canine molar.

Megalonyx wheatleyi Cope. Wheatley's Ground Sloth.

1871. *Megalonyx wheatleyi* Cope, Proc. Amer. Philos. Soc., xii, p. 75, figs. 1, 3–8.

1871. *Megalonyx dissimilis* Cope (not Leidy), Proc. Amer. Philos. Soc., xii, p. 83.

1871. *Megalonyx sphenodon* Cope, Proc. Amer. Philos. Soc., vol. xii, p. 83.

Type locality.—Port Kennedy, l. c. Type in Amer. Mus. Nat. Hist., N. York.?

Pleistocene. Port Kennedy, Montgomery Co., Penna. Remains very abundant.

Megalonyx tortulus Cope. Cope's Lesser Ground Sloth.

1871. *Megalonyx tortulus* Cope, Proc. Amer. Philos. Soc., xii, p. 84, fig. 12.

Type locality.—Port Kennedy, l. c. Type in Amer. Mus. Hist., N. York.?

Pleistocene. Port Kennedy, Montgomery Co., Penna. Canine and posterior molars.

Megalonyx scalper Cope. Chisel-tooth Ground Sloth.

1899. *Megalonyx scalper*, Cope, Journ. Acad. Nat. Sci., Phila., (2), xi, pt. ii, p. 218, pl. xviii, figs. 2 and 2a.

Type locality.—Port Kennedy, l. c. Type No. 84, Mus. A. N. S.

Pleistocene. Port Kennedy, Montgomery Co., Penna. Canine molar.

This species and *M. loxodon* are probably based on aberrant forms of *M. wheatleyi*. The improbability of four species of *Megalonyx*, distinct from *M. jeffersoni*, occurring side by side in the same bone pit, is further emphasized by the fact that many intermediate forms between specimens taken as the types of Prof. Cope's species are to be found in this collection. I concur with Prof. Cope that *M. wheatleyi* seems entitled to rank as distinct from *M. jeffersoni*.

LIST OF CORRESPONDENTS WHOSE NAMES APPEAR IN THIS WORK.

Abbott, Charles C., Trenton, Mercer Co., N. J.
Allen, J. A., American Museum, Nat. History, N. York.
Austin, E. O., Austin, Potter Co., Pa.
Babcock, W. C., Blossburg, Tioga Co., Pa.
Bacon, S. E., Erie, Erie Co., Pa.
Bangs, Outram, 240 Beacon st., Boston, Mass.
Behr, Otto, Lopez, Sullivan Co., Pa.
Bennett, Richard, Eaglesmere, Sullivan Co., Pa.
Bisbing, Randall, Minsi, Monroe Co., Pa.
Buckalew, John M., Fishing Creek, Columbia Co., Pa.
Campbell, E. W., Pittston, Luzerne Co., Pa.
Chambers, J. B., Mifflinburg, Union Co., Pa.
Chew, Miss Ivy, Chew's Landing, Gloucester Co., N. J.
Clay, A. A., Rasselas, Elk Co., Pa.
Cleveland, J. E., Canton, Bradford Co., Pa.
Coffin, Bodine, May's Landing, Atlantic Co., N. J.
Crawford, W. B., Chambersburg, Franklin Co., Pa.
Davidson, Alvin, Campus, Easton, Northampton Co., Pa.
Day, Geo. N., Dyberry, Wayne Co., Pa.
Dorworth, H. C., Oil City, Venango Co., Pa.
Dickeson, W. C., Colegrove, McKean Co., Pa.

Dickinson, C. W., Smethport, McKean Co., Pa.
Edinger, James, Stroudsburg, Monroe Co., Pa.
Evans, William B., Moorestown, Burlington Co., N. J.
Fernald, H. T.. Amherst, Mass.
Fenton, T. J., Jamestown, N. Y.
Friant, Geo. P., Scranton, Lackawanna Co., Pa.
Fry, Mrs. Norman, Laughlintown, Westmoreland Co., Pa.
Gifford, John, Ithaca, N. Y.
Goodnough, L. N., Rileyville, Wayne Co., Pa.
Grinnell, Geo. B., Broadway, N. York City.
Haines, George, Medford, Burlington Co., N. J. (deceased)
Hand, H. Walker, Cape May, C. May Co., N. J.
Haslet, S. H., Tionesta, Forest Co., Pa.
Ingersoll, J. C., of Maryland (deceased).
Irwin, Sam'l D., Tionesta, Forest Co., Pa.
Jillson ("Brothers"), Tuckerton, Ocean Co., N. J.
Kellew, John, Carley Brook, Wayne Co., Pa.
Kirkpatrick, H. C., Meadville, Crawford Co., Pa.
Larrabee, W. W., Emporium, Clinton Co., Pa.
Lee, Francis B., Trenton, Mercer Co., N. J.
Linton, Edward, Washington, Washington Co., Pa.
Luhr, Charles, St. Marys, Elk Co., Pa.
McGuigan, S., Port Mercer, Mercer Co., N. J.
McHenry, W. E., Cambria Iron Works, Johnstown, Cambria Co., Pa.
Mercer, H. C. Doylestown, Bucks Co., Pa.
Merriam, C. Hart, Dept. Agriculture, Washington, D. C.
Mier, Samuel, Elk Lick, Somerset Co., Pa.
Miller, Gerrit S., Jr., National Museum, Washington, D. C.
Miller, W. D. W., Plainfield, Union Co., N. J.
Moore, Henry D., New Lexington, Somerset Co., Pa.
Nease, Jas. S., Washington, Washington Co., Pa.
Nelson, Julius, Rutgers College, N. Brunswick, N. J.
Nelson, Seth Iredale (Sr.), Round Island, Clinton Co., Pa.
Nelson, Seth (Jr.), Round Island, Clinton Co., Pa.
Nelson, William, Paterson, Essex Co., N. J.
Parker, L. E., Pennsdale, Lycoming Co., Pa.
Pfoutz, C. C., Farrandsville, Clinton Co., Pa.
Pharo, M. W., Haddonfield, Camden Co., N. J.
Phillips, A. L., Princeton, Mercer Co., N. J.
Preble, E. W., Dept. Agric., Washington, D. C.
Putnam, F. W., Peabody Museum, Cambridge, Mass.
Price, T. P., Tuckerton, Ocean Co., N. J.

Ray, David, Lawrence Sta., Mercer Co., N. J.
Rehn, J. A. G., Acad. Nat. Sciences, Philadelphia, Pa.
Robinson, Alva T., Forkston, Wyoming Co., Pa.
Roddy, Justin, Millersville, Lancaster Co., Pa.
Roosevelt, Theodore, White House, Washington, D. C.
Rothrock, J. T., West Chester, Chester Co., Pa.
Savage, Jas., Buffalo, New York.
Scott, W. E. D., Princeton, Mercer Co., N. J.
Shields, H. A., Johnstown, Cambria Co., Pa.
Silvester, C. F.. Princeton Univ., Mercer Co., N. J.
Stevens, G. D., Maplewood, Wayne Co., Pa.
Stocker, J. E., Luzerne Co., Pa.
Stone, Witmer, Acad. Nat. Sciences, Philadelphia, Pa.
Strealy, M. W., Chambersburg, Franklin Co., Pa.
Strickland, Charles, Blairstown, Warren Co., N. J.
Teeple, Elijah, Lookout, Wayne Co., Pa.
Todd, W. E. C., Carnegie Mus., Pittsburg, Alleghany Co., Pa.
True, F. W., National Museum, Washington, D. C.
Valiant, W. S., Rutgers Museum, N. Brunswick, N. J.
Van Note, G. H., Barnegat, Atlantic Co., N. J.
Von Lengerke, J., Broadway, N. York City.
Williams, Walter, Greenwich, Cumberland Co., N. J.
Warren, B. H., West Chester, Chester Co., Pa.
Zendel, Christopher, Newtown Mills, Forest Co., Pa.

THE END.

INDEX.

A.

Aceratherium matutinum, 236
acuto-rostrata, Balænoptera, 11, 14
acutus, Lagenorhynchus, 224
Agabelus porcatus, 248
Agaphelus gibbosus, 12
albibarbis Neosorex, 191
    Sorex, 191
    " palustris, 191
Alces americanus, 224
    scotti, 240
Allegheny Cave Rat, 85, 243
    Cottontail or Rabbit, 121
    Cougar, Panther, 126
Alleghenian Least Weasel, 173
    Varying Hare, 118
allegheniensis, Putorius, 173
American Badger, 231
    Bison, 47, 239
    Sable, 176
americana, Alces, 224, 240
    Mustela, 176
    Ursus, 183, 228
americanus, Alces, 240
    Bison, 239
    borealis, Odocoileus, 24, 26
    canadensis, Sitomys, 77
    Cervalces, 240
    Cervus, 240
    " dama, 24
    Elephas, 234
    fossilis, Tapirus, 236
    Mastodon, 234
    Meriones, 111
    Odocoileus, 24, 241
    virginianus, Lepus, 118
Ammodon leidyanum, 237
ampullatus, Balæna, 16
    Hyperoödon, 16
Anaptogonia hiatidens, 244
    clovacinum, 244
Anchippodus riparius, 233
antiquus, Dicotyles, 238
    Perchœrus, 239
    Physeter, 248
    vetus, Physeter, 248
    Thinohyus, 239
Appalachian Cave Bear, 228
    Gray or Timber Wolf, 148, 228
    Musk Ox, 239
    Porcupine, 242
    Rhinoceros, 236
appalachicolus, Bison, 239
    Ovibos, 239
aquaticus, Scalops, 198, 227
    Sorex, 198
Arctomys, genus, 63
    franklini, 221
    monax, 63, 243
    " canadensis, 66
aries, Ovis, 217
Arvicola didelta, 245
    gapperi, 92
    hiatidens, 244
    involuta, 245
    riparius, 244
    scalapsoides, 101
    sigmodus, 245
    speothen, 244
    tetradelta, 244
atlanticus, Macrophoca, 247
    Squalodon, 247

B.

Badger, American, 231
Balæna ampullatus, 16
    cisarctica, 10
    genus, 10
    glacialis, 10, 12
    musculus, 13
    mysticetus, 11
    nodosa, 14

Balæna physalus, 12
Balænidæ, 10
Balænoptera, genus, 11
acuto-rostrata, 11, 14
musculus, 13
physalus, 12, 13
Baleen, 10
Whales, 10, 12
Barren Ground Caribou, 241
Barton's Zapus, 110
Bats, 207, 227
Bat, Big-eared, 226
Georgia Pigmy, 210
Hoary, 214
House, 212, 227
Leconte's Little Brown, 207
Northeastern Large Brown, 212, 227
Northern Red, 213
Rafinesque's Little Brown, 215
Say's, 208, 227
Silvery Black, 210
Tree, 213
Batchelder's Shrew, 226
Bay Lynx, Eastern, 141
Beaked Whale, Cuvier's, 16
Bears, 4, 5, 183, 228
Bear, Appalachian Cave, 228
Black, 183, 228
Cave, 5
Beaver, 5, 67, 243
American, 243
Canada, 67, 223
Giant, 5
Great Fossil, 245
Southeastern, 73
bidens, Mesoplodon, 17
Physeter, 17
Big Water Shrew, 191
Biserrate Squalodon, 247
Bison, 5, 47, 239
American, 47, 239
americanus, 239
appalachicolus, 239
bison, 47, 239
genus, 47
latifrons, 239
Blackfish, Northern, 21
Black Whale, 10
Bladder-nose Seal, 126
Blarina, genus, 192
Blarina brevicauda, 192, 193
carolinensis, 193
parva, 196
simplicidens, 227
Blue Whale, Great, 13
Bonaparte's Weasel, 158
boops, Megaptera, 14
borealis, Lasiurus, 213
Odocoilus americanus, 24, 26
Vespertilio, 213
Bos, 239
bison, 47
moschatus, 239
taurus, 217
Bottled-nosed or Beaked Whale, 16
Bottle-nose Dolphin, 17
Bovidæ, 47, 239
brachyptera, Globicephala, 21, 22
brevicauda, Blarina, 192, 193
Sorex, 193
breviceps, Kogia, 15
Physeter, 15
breweri, Parascalops, 204
Scalops, 204
Brewer's Mole, 204
Buffalo, 47

C.

caballus, Equus, 217
calcaratus, Lynx, 232
calycinus, Sciurus, 242
Cameloid Deer, Cope's, 240
Canada Beaver, 67
Canadian Flying Squirrel, 225
Lynx, East, 136
Chickaree, 52
canadensis, Arctomys monax, 66
carolinensis, Castor, 73
Castor, 67, 223, 243
Cervus, 29, 241
" elaphus, 29, 39
Felis, 232
Glis, 66
Lutra, 156
" lataxina, 162
lutra, Mustela, 156
Lynx, 136, 232
nubiterræ, Peromyscus, 79
Peromyscus, 77
Sitomys americanus, 77

Canidæ, 143, 228
Canis, genus, 148
cinereoargenteus, 143
familiaris, 220
fulvus, 145
lupus, 228
mexicanus, 223
" nubilus, 148, 228
nubilus, 148
priscolatrans, 228
Carcajou, 164
Cariacus lævicornis, 242
virginianus, 241
Caribou, 6, 241
Barren Ground, 241
Rangifer, 241
Woodland, 241
Carnivores, 5, 127, 228
Carolina Gray Squirrel, 52, 242
carolinensis, Blarina, 193
Castor canadensis, 73
leucotis, Sciurus, 52
Sciurus, 52, 242
Castor, genus, 67
canadensis, 67, 223, 243
" carolinensis, 73
fiber, 243
zibethicus, 104
Castoridæ, 67, 243, 245
Castoroides ohioensis, 245
Cat, Domestic, 220
Eyra, 232
Fossil American Wild, 232
Sabre-toothed, 5, 6
Wild, 4, 5, 141
Catodon vetus, 248
Cattle, 217
Cave Bear, 5
Rat, Allegheny, 85, 243
carvirostris, Ziphius, 16
Cervalces americanus, 240
Cervidæ, 24
Cervus, Genus, 29, 241
americanus, 240
canadensis, 29, 241
dama americanus, 24
elaphus canadensis, 29
tarandus, 241
virginianus, 241
Cetacea, 4, 5, 10, 247
Chickaree (Canadian), 56
Chickaree, Cope's Fossil, 242
Southeastern, 57
Chipmunk, Eastern, 242
Northeastern, 61
Southeastern, 61
Chiroptera, 207, 227
cicognani, Mustela, 168
Putorius, 168
cinereoargenteus, Canis, 143
Urocyon, 143, 229
cinereus, Lasiurus, 214
Vespertilio, 214
cisarctica, Balæna, 10
Citellus franklini, 221
cloacinum, Anaptogonia, 244
Erethizon, 242
Sycium, 244
Cloudland Deer Mouse, 79
clymene, Delphinus, 19
cœlospondylus, Ixacanthus, 248
Common Dolphin, 18
Porpoise, 17
Weasel, 170
communis, Phocæna, 21
Complicate Fossil Horse, 237
complicatus, Equus, 237
concolor, Felis, 134
Condylura genus, 206
cristata, 206
Coons, 4, 182
Cooper's Lemming, 106
cooperi, Synaptomys, 106
stonei, Synaptomys, 106
Cope's Cameloid Deer, 240
Fossil Chickaree, 242
" Peccary, 238
" Pika, 246
Lesser Ground Sloth, 249
Corynorhinus macrotis, 226
Cougar, 5, 127
couguar, Felis, 127
Cow Fish (or) Grampus, 21
Cowfish (or) Sowerby's Whale, 17
Coyote, Fossil, 228
crassidens, Pseudorca, 223
cristata, Condylura, 206
Crystophora, 126
Phoca, 126
Sorex, 206
Crocuta inexpectata, 232
Cuvier's Beaked Whale, 16

Cystophora, genus, 126
cristata, 126

D.

Deer, 5, 24, 241, 242, 243
Cope's Cameloid, 240
Northern Virginia, 26
Slender Horned Fossil, 242
Virginia, 24, 241
Deer-Mouse, Canada, 2
Cloudland, 79
Fisher's, 81
Golden, 225
Miller's, 77
Rafinesque's, 79, 243
Delphinapterus hawkinsii, 247
lacertosus, 247
Delphinidæ, 17
Delphinus, genus, 18
clymene, 19
delphis, 18
erebennus, 18
griseus, 21
melas, 21
orca, 23
phocæna, 20
plagiodon, 19
tursio, 17
delphis, Delphinus, 18
Dicotyles antiquus, 238
nasutus, 238
pennsylvanicus, 238
Didelphidæ, 8
Didelphis, genus, 8
virginiana, 8
didelta, Arvicola, 245
microtus, 245
Diluvian Vole, 244
diluvianus, Microtus, 244
Dipodidæ, 109
Dipus hudsonius, 109
dissimilis, Megalonyx, 249
Dog, Domestic or Indian, 220
Dolphins, 4, 5, 8, 247
Dolphin, Bottle-nose, 17
Common, 18
Harlan's Sword, 247
Ixacanth Sword, 248
Lacertine Sword, 247
Porcate Sword, 248
Dolphin, Shark-toothed, 6
Spotted, 19
Striped, 224
Urean, 247
domesticus, Felis, 220
doris, Prodelphinus, 20
dorsata, Erethizon, 114, 242
Hystrix, 114
Dugongidæ, 246
Dugong, Great Extinct, 246
Dugongs, 5, 241

E.

East American Black Bear, 183
Eastern Bay Lynx, 141
Hairy-tail Mole, 204
Marsh Shrew, 191
Masked Shrew, 189
Moose, 224
Naked-tail mole, 198, 227
Prairie Cotton-tail, 122, 223
Wapiti, 29
Edentates, 5, 249
effodiens, Hemicaulodon, 246
elaphus, Cervus, 39
Elephant, 5, 234
Elephantidæ, 234
Elephas americanus, 234
Elk, 5, 29, 241
Elotherium leidyanum, 237
Eptesicus, genus, 212
fuscus, 212, 227
Equus caballus, 217
complicatus, 237
fraternus, 237
" pectinatus, 237
major, 237
pectinatus, 237
erebennus, Delphinus, 18
Erethizon, genus, 114
cloacinum, 242
dorsatum, 114, 242
Erethizontidæ, 114, 242
euphrosyne, Prodelphinus, 19
europæus, Lepus, 220
Evotomys, genus, 92
gapperi, 92
" rhoadsi, 94
Eyra Cat, 232
eyra, Felis, 232

Extinct Species, 5, 6, 227

F.

familiaris, Canis, 220
Fauna, Arctic, 3, 6
Austral, 3
Boreal, 3
Canadian, 3
Hudsonian, 3
Transition, 3
Tropical, 3
Faunal Areas or Life Zones, 3
Felidæ, 127, 231
Felis, genus, 127
canadensis, 232
concolor, 134
couguar, 127
domesticus, 220
eyra, 232
hippolestes, 134
inexpectatus, 232
ruffus, 141
Feræ, 127, 228
Fiber, genus, 104
zibethicus, 104, 245
Castor, 243
Fin-Back, 11, 12
Great, 12
Least, 11
Finfisch, Martens', 13
Fischer's Deer Mouse, 81
Fisher, 2, 179
fisheri, Sorex longirostris, 226
Fisher's Shrew, 226
floridana, Neotoma, 243
floridanus mearnsi, Lepus, 223, 122
mallurus, 122, 246
transitionalis, Lepus, 121
Flying Squirrel, Virginia, 66
fossidens, Mephitis, 230
Fossil American Marten, 229
" Wild Cat, 232
Atlantic Walrus, 233
Beaver, Great, 245
Chickaree, Cope's, 242
Coyote, 228
Deer, Slender Horned, 242
Horse, Complicate, 237
" Pectinate, 237
Mammals, 5, 6, 227
Fossil Mole Shrew, 227
Moose, Scott's, 240
Otter, American, 231
Peccary, Cope's, 238
" Long snouted, 238
" Marsh's, 238
" Pennsylvania, 238
Pig, Leidy's, 237
Pika, Cope's, 246
Pine Vole, 245
Puma, 232
Red Fox, 229
Sea Leopard, 233
Skunk, Intermediate, 230
" Pigmy, 230
" Pitted-tooth, 230
" Slender-jawed, 230
Tapir, Hay's, 236
" Marsh's, 236
Vole, Involute, 245
" Isodeltan, 244
Weasel, Great, 231
fossilis, Tapirus americanus, 236
Foxes, 4, 5, 143
Fox, European Red, 221
Fossil Red, 229
Northeastern Gray, 143, 228
Southeastern Red, 143
Squirrel, Western, 57
" Northeastern, 58
franklini, Arctomys, 221
Citellus, 221
Spermophilus, 222
Franklin's Spermophile, 221
fraternus, Equus, 237
pectinatus, Equus, 237
frontata, Mephitis, 230
fulvus, Canis, 145
Vulpes, 145
fumeus, Sorex, 190
fuscus, Eptesicus, 212, 227
Vespertilio, 212, 227

G.

gapperi, Evotomys, 92
Arvicola, 92
rhoadsi, Evotomys, 94
Gapper's Wood Vole, 92
Georgia Pigmy Bat, 210
gibbosus, Agaphelus, 12

glacialis, Balæna, 10
Glires, 52, 242
Glis canadensis, 66
Globicephala brachyptera, 21, 22
melas, 21, 22
scammoni, 22
Glutton, 164
Gopher, Gray, 221
gossypinus, Peromyscus, 80
gracilis, Machærodus, 231
Smilodon, 231
Grampus, 12, 21, 223
griseus, 21
grandævus, Priscodelphinus, 247
Gray Fox, Northeastern, 143, 229
Gray Wolf, 148
Great Blue Whale, 13
griseus, Grampus, 21
grœnlandica, Phoca, 125
grœnlandicus, Rangifer, 241
Ground Hog, Northeastern, 66
Southeastern, 63
Ground Squirrel, 61, 221
Gulo, genus, 164
luscus, 164, 165, 229
gymnicus, Sciurus hudsonius, 56

H.

haplodon, Ursus, 228
Harbor Porpoise, 20
Seal, 123
Hare, 118
Alleghenian, Varying, 118
European or Belgian, 220
Northern, 2
harlani, Mylodon, 249
Priscodelphinus, 247
Harlan's Ground Sloth, 249
Sword Dolphin, 247
Water Rat or Mouse, 81
Harp Seal, 125
hawkinsii, Delphinapterus, 247
Hay's Fossil Tapir, 236
haysii, Tapirus, 236
Hedgehog, 114
Hemicaulodon effodiens, 246
Herring Hog, 20
Hesperomys leucopus, 243
hiatidens, Anaptagonia, 244
Arvicola, 244
hippolestes, Felis, 134
Hoary Bat, 214
Hooded Seal, 126
Hoofed Mammals, 24
Horse, 5, 217, 237
Complicate Fossil, 237
Pectinate Fossil, 237
House Bat, 212
Hoy's Shrew, 226
hoyi, Sorex, 226
Hudson Bay Zapus, 106
hudsonius, Dipus, 109
gymnicus, Sciurus, 56
loquax, Sciurus, 57
Jaculus, 245
Zapus, 109, 245
humeralis, Nycticeius, 215
Vespertilio, 215
Humpback Whale, New England, 14
Hyperoödon, genus, 16
ampullatus, 16
Hystrix dorsata, 114

I.

impiger, Reithrodontomys leconti, 225
inexpectata, Felis, 232
Crocuta, 232
Uncia, 232
Insectivora, 189, 227
insignis, Zapus, 113
involuta, Arvicola, 245
Microtus, 245
Involute Fossil Vole, 245
Isodeltan Fossil Vole, 244
Ixacanth Sword Dolphin, 248
Ixacanthus coelospondylus, 248

J.

Jaculus hudsonius, 245
Jumping Mouse, Meadow, 109, 110
" Miller's, 113
" Woodland, 2

K.

Killer, Black, 223
White-Bellied, 23
Kogia, genus, 15
breviceps, 15

L.

Lacertine Sword Dolphin, 247
lacertosus, Dephinapterus, 247
Priscodelphinus, 247, 248
lævicornis, Cariacus, 242
Odocoileus, 242
Lagenorhynchus acutus, 224
Lasionycteris noctivagans, 210
Lasiurus, genus, 213
borealis, 213
cinereus, 214
lataxina, Lutra, 162
" canadensis, 162
latidentatus, Vulpes, 229
latifrons, Bison, 239
Least Mole Shrew, 196
Rorqual, 11
Leconte's Little Brown Bat, 207
leconti impiger, Reithrodontomys, 225
leidyanum, Ammodon, 238
Elotherium, 237
Leidy's Fossil Pig, 237
Platygone Peccary, 239
Sperm Whale, 248
Lemming, Cooper's, 106
Stone's, 106
Leporidæ, 118, 246
leptops, Mephitis, 230
Lepus, genus, 118
americanus virginianus, 118
europæus, 220
floridanus mallurus, 122, 246
" mearnsi, 122, 223
" transitionalis, 121
nuttalli mallurus, 122
sylvaticus mearnsi, 122
" transitionalis, 121
virginianus, 118
Lesser Weasel, 168
lesueuri, Sorex personatus, 226
Lesueur's Shrew, 226
leucopus, Hesperomys, 243
Musculus, 79
novoboracensis, Peromyscus, 81
nubiterræ, Peromyscus, 79
Peromyscus, 79, 243
leucotis, Sciurus, 52
" carolinensis, 52
Life Zones, 3
lineata, Phocæna, 20
Little Piked Whale, 11
lobulatus, Pelycictis, 230
Lagomys palatinus, 246
longirostris fisheri, Sorex, 226
Long-tailed Mole, 206
Weasel, 170
Lophiodon validus, 236
loquax, Sciurus hudsonius, 57
lotor, Procyon, 182, 228
Ursus, 182
Lowland Cottontail Rabbit, 122
loxodon, Megalonyx, 249
Loxodont Ground Sloth, 249
lucifugus, Myotis, 207
Vespertilio, 207
luscus, Gulo, 164, 165, 229
Ursus, 164
lupus, Canis, 228
Lutra, genus, 156
canadensis, 156, 157
" mustela, 156
" lataxina, 162
lataxina, 156
rhoadsii, 231
lutreocephalus, Mustela, 167
Putorius vison, 167
Lynx, genus, 136
calcaratus, 232
Canada, 2, 5, 232
canadensis, 136, 232
East Canadian, 136, 232
Eastern Bay, 141
ruffus, 136, 141, 232
lysteri, Sciurus (Tamias), 61
Tamias striatus, 61

M.

Machærodus gracilis, 231
merceri, 232
macrocephalus, Physeter, 14
Macrophoca atlanticus, 247
macrotis, Corynorhinus, 226
Sciuropterus sabrinus, 225
Macroxus neglectus, 58
magister, Neotoma, 85, 243
major, Equus, 237
mallurus, Lepus floridanus, 122, 246
" nuttalli, 122
Mammals, Existing, 5, 6
Extinct, 5, 6

Mammals, Fossil, 5, 6
Recent, 5, 6, 8
Mammut americanus, 234
ohioticum, 234
Manatus sp., 5, 246
Marmot, Maryland, 243
Marsh or Rice Rat, Northern, 81
Marsh's Fossil Peccary, 238
" Tapir, 236
Marsupialia, 8
Marsupials, 8
Marten, 2, 176, 229
Fossil American, 229
Pennant's, 179
Southeastern, 176
Marten's "Finfisch," 13
Mastodon, 6, 234
americanus, 234
Ohioan, 234
matutinum, Aceratherium, 236
Rhinoceros, 236
mearnsi, Lepus floridanus, 122, 223
" sylvaticus, 122
Megaptera, genus, 14
boops, 11, 14
nodosa, 14
osphyia, 14
Megalonyx dissimilis, 249
loxodon, 249
scalper, 250
sphenodon, 249
tortulus, 249
wheatleyi, 249
melas, Delphinus, 21
Globicephalus, 21, 22
Mephitis, genus, 163
fossidens, 230
frontata, 230
leptops, 230
mephitica, 230
mephitis putida, 163, 230
obtusatus, 230
orthostichus, 230
putida, 163
merceri, Machærodus, 232
Uncia, 232
Mercer's Sabre-tooth Tiger, 232
Meriones americanus, 111
Mesoplodon, genus, 17
bidens, 17
mexicanus, Canis, 223
mexicanus, nubilus, Canis, 148, 228
Mice, 77, 243
Microtus, genus, 97
diluvianus, 244
dideltus, 245
involutus, 245
pennsylvanicus, 97, 107, 244
pinetorum, 4
" scalapsoides, 101
speothen, 244
Miller's Jumping Mouse, 112
Minks, 4, 167
Mink, Northeastern, 167
Southeastern, 167
missouriensis, Mylodon, 249
Oryctotherium, 249
Mole, 4, 198, 204, 227
Brewer's, 204
Common, 198
Eastern Hairy Tail, 204
" Naked Tail, 198, 227
Long-tailed. 206
Star-nose, 206
Swamp, 206
Shrew, Fossil, 227
" Least, 196
" Northeastern, 192
Monax, Arctomys, 63, 243
canadensis, Arctomys, 66
Musty, 63
Moose, 6, 224, 240
East American, 240
Eastern, 224
Scott's Fossil, 240
moschatus, Bos, 239
Ovibos, 239
Mouse, Canada Deer, 2
Cloudland Deer, 79
Fischer's Deer, 81
Golden Deer, 225
Harvest, 225
Miller's Deer, 77
Rafinesque's Deer, 79, 243
Common Meadow, 97
House, 218
Meadow, 97
" Jumping, 109, 110
Miller's Jumping, 113
Woodland Jumping, 2
Mole, 4, 101
Red Back, 92, 94

Mouse, Virginia Harvest, 225
Wood, 7
Muridæ, 77, 243
Mus monax, 63
musculus, 218
norvegicus, 218
palustris, 81
pinetorum, 97
rattus, 218
sylvaticus noveboracensis, 81
volans, 6, 7
musculus, Balænoptera, 13
Balæna, 13
leucopus, 79
mus, 2, 18
Musk Ox, 6, 239
" Appalachian, 239
Muskrat, 4, 204, 245
Eastern, 245
Southeastern, 104
Mustela, genus, 176
americana, 176
cicognani, 168
diluviana, 229
lutra canadensis, 156
lutreocephala, 167
pennanti, 179
putida, 163
vison, 167
Mustelidæ, 156, 229
Mylodon harlani, 249
missouriensis, 249
Mylohylus nasutus, 238
pennsylvanicus, 238
tetragonus, 238
Myotis, genus, 207
lucifugus, 207, 227
subulatus, 208, 227
mysticetus, Balæna, 11

N.

nasutus. Dicotyles, 238
Mylohyus, 238
neglectus, Macroxus, 58
Sciurus rufiventer, 58
Neotoma, genus, 85
floridana, 243
magister, 85, 243
pennsylvanica, 85, 86
Neosorex, albibarbis, 191
New England Humpback Whale, 14
New Jersey Wood Vole, 94
New York Pigmy Bat, 211
New York Weasel, 170, 229
noctivagans, Lasionycteris, 210
Vespertilio, 210
nodosa, Balæna, 14
Megaptera, 14
Northeastern or Canada Beaver, 67
Chipmunk, 61
Fox Squirrel, 58
Gray Fox, 143
Large Brown Bat, 212
Mink, 167
Mole Shrew, 192
Otter, 156
Racoon, 182
Woodchuck, 66
Northern Blackfish, 21
Gray or Black Squirrel, 52
Red Bat, 213
Rice or Marsh Rat, 81
Virginia Deer, 26
norvegicus, Mus, 218
noveboracensis, Mus sylvaticus, 81
Peromyscus leucopus, 80, 81
Putorius, 170, 229
nubilus, Canis, 148
" mexicanus, 148, 228
nubiterræ, Peromyscus canadensis, 79
nuttalli, mallurus, Lepus, 122
Peromyscus, 79, 225
Nycticeius, genus, 213, 215
humeralis, 215

O.

obscurus, Pipistrellus subflavus, 211
obtusatus, Mephitis, 230
Ochotona palatinus, 246
Odocoileus, genus, 24, 241
americanus, 24, 241
" borealis, 24, 26
lævicornis, 242
Ogmorhinus vetus, 233
Ohioan Mastodon, 234
ohioensis, Castoroides, 245
ohioticum, Mammut, 234
Mastodon, 234
Opossum, Virginia, 8
orca, Delphinus, 23

Orcinus, genus, 23
orca, 23
orientalis, Teleopternus, 240
orthostichus, Mephitis, 230
Oryctotherium missouriense, 249
Oryzomys, genus, 81
palustris, 81
Osmotherian Skunk, 230
Osmotherium spelæum, 230
osphyia, Megaptera, 14
Otter, 5, 156, 229
American Fossil, 231
Northeastern, 156
Southeastera, 162
Ovibos (Boötherium) appalachicolus, 239
moschatus, 239
Ovis aries, 217
Oxen, 5
Ox, Musk, 6, 239

P.

palatinum, Lagomys, 246
Praotherium, 246
palatinus, Ochotona, 246
palustris albibarbis, Sorex, 191
Mus, 81
Oryzomys, 81
Panther, 5, 127
Alleghenian Cougar or, 127
Parascalops, genus, 204
breweri, 204
parva, Blarina, 196
parvus, Sorex, 196
Peccary, 5, 6, 238
Cope's Fossil, 238
Long-snouted Fossil, 238
Marsh's Fossil, 238
Pennsylvania Fossil, 238
Leidy's Platygone, 239
pectinatus, Equus, 237
" fraternus, 237
Pekan, 179
Pelycictis lobulatus, 231
pennanti, Mustela, 179
Pennant's Marten, 179
Pennsylvania Meadow Vole, 97
pennsylvanicus, Dicotyles, 238
Microtus, 97, 244
Mus, 97
pennsylvanicus Mylohyus, 238
pennsylvanica, Neotoma, 85, 86
Perchœrus antiquus, 239
Peromyscus, genus, 77
canadensis, 77
" nubiterræ, 79
gossypinus, 80
leucopus, 79, 243
" noveboracensis, 80, 81
" nubiterræ, 79
nuttali, 79, 225
personatus, Sorex, 189
lesueuri, Sorex, 226
Phoca, genus, 123
cristata, 126
grœnlandica, 125
vitulina, 123
Phocæna, genus, 20
communis, 21
lineata, 20
phocæna, 20
phocæna Delphinus, 20
Phocæna, 20
Phocidæ, 123, 233
Physeter, genus, 14, 248
antiquus, 248
" vetus, 248
bidens, 17
breviceps, 15
macrocephalus, 14
vetus, 248
Physeteridæ, 14
Pig, Leidy's Fossil, 237
Pigmy Sperm Whale, 15
Pika, 5, 246
Cope's Fossil, 246
Piked Whale, 11
Pilot Whale, 21
Pine Squirrel, 56
pinetorum scalopsoides, Microtus, 101
Pinnipedia, 123, 233
Pinnipeds, 5, 123, 233
Pipistrellus, genus, 210
subflavus, 210, 211
" obscurus, 211
plagiodon, Prodelphinus, 19
Plantanistidæ, 247
Platigonus vetus, 239
Pleistocene, 6
Porcate Sword Dolphin, 247
porcatus, Agabelus, 247

Porcupine, Appalachian, 242
Canada, 114
Porpoise, Common, 17
Harbor, 20
Ring-eyed, 18
Skunk, 224
Post Pleiocene, 6
Prairie Cottontail, Eastern, 122
Praotherium palatinum, 246
Priscodelphinus grandævus, 247
harlani, 247
lacertosus, 247
uraeus, 247
priscolatrans, Canis, 228
Procyon, genus, 182
lotor, 182, 228
Procyonidæ, 182, 228
Prodelphinus, genus, 19
doris, 20
euphrosyne, 19
plagiodon, 19
Pseudorca crassidens, 223
Pughead Whale, 16
Puma, Fossil, 232
putida, Mephitis mephitis, 163
Mustela, 163
Putorius, genus, 167
allegheniensis, 173
cicognani, 168
noveboracensis, 170, 229
rixosus, 173
vison, 167
" lutreocephalus, 167

R.

Rabbit, 118, 223, 246
Alleghenian Cottontail or, 121
Eastern Prairie Cottontail or, 122, 223
Jack, 120
Southeastern or Lowland Cottontail, 122, 246
White, 118
Racoon, Northeastern, 182, 228
Rafinesque's Deer Mouse, 79, 243
Little Brown Bat, 215
Rangifer Caribou, 241
grœnlandicus, 241
riparius, Arvicola, 244
Rat, 5, 81, 243
Rat, Allegheny Cave, 85, 243
Black, 218
Cave, 6, 85
Northern or Marsh, 81
Norway, 6, 218
rattus, Mus, 218
Redback Mouse or Wood Vole, 92, 94
Red Fox, Southeastern, 145
Reithrodontomys leconti impiger, 225
Rhinoceros, 5, 6, 236
matutinum, 236
Rhinocerotidæ, 236
rhoadsi, Evotomys gapperi, 92, 94
rhoadsii, Lutra, 231
Right Whale, 12
Ring-Eyed Porpoise, 18
riparius, Anchippodus, 233
rixosus, Putorius, 173
Rodents, 5, 52, 242
Rorqual, Least, 11
Rosmaridæ, 233
Rosmarus virginianus, 233
ruffus, Felis, 141
Lynx, 136, 141, 232
rufiventer, Sciurus, 57, 225
neglectus, 58

S.

"Sable," American, 176
sabrinus macrotis, Sciuropterus, 225
Say's Little Brown Bat, 208
Scalops, genus, 198
aquaticus, 198, 227
breweri, 204
scalopsoides, Microtus pinetorum, 101
Arvicola, 101
scalper, Meglonyx, 250
scammoni, Globiocephalus, 22
Sciuridæ, 52, 242
Sciuropterus, genus, 66
sabrinus microtis, 225
volans, 66, 67
Sciurus calycinus, 242
carolinensis, 52, 242
" leucotis, 52
hudsonius gymnicus, 56
" loquax, 57
rufiventer, 57, 225
" neglectus, 58
striatus, 61

Sciurus (Tamias) lysteri, 61
scotti, Alces, 240
Scott's Fossil Moose, 240
scrofa, Sus, 217
Sea Dog, 123
Sea Leopard, Fossil, 223
Seal, Harbor, 123
Harp, 125
Hooded, 126
Sheep, 217
Short-tailed Weasel, 168
Shrews, 4, 5, 189, 227
Shrew, Batchelder's, 226
Eastern Marsh, 191
" Masked, 189
Fisher's, 226
Hoy's, 226
Lesueur's, 226
Marsh, 2
Smoky, 189
Water, 191
Fossil Mole, 227
Least Mole, 196
Northeastern Mole, 192
sigmodus, Arvicola, 245
Silvery Black Bat, 210
simplicidens, Blarina, 227
Sirenians, 5, 6, 246
Sitomys americanus canadensis, 77
Skunk, 4, 5, 156, 229
Intermediate, 230
Osmotherian, 230
Pigmy Fossil, 230
Pitted-tooth Fossil, 230
Slender-jawed Fossil, 230
Southeastern, 163, 230
Sloth, Chisel-tooth Ground, 250
Cope's Lesser Ground, 249
Diastemodont Ground, 249
Giant, 5, 6
Harlan's Ground, 249
Loxodont Ground, 249
Wheatley's Ground, 249
Smilodon gracilis, 231
mercerii, 232
Sorex, genus, 189
albibarbis, 191
aquaticus, 198
cristata, 206
fumeus, 190
hoyi, 226
Sorex, longirostris fisheri, 226
macrurus, 226
palustris albibarbis, 191
parvus, 196
personatus, 189
" lesueuri, 226
talpoides, 195
Soricidæ, 189, 227
Southeastern Beaver, 73
Chickaree, 57
Chipmunk, 61
Marten, 176
Mink, 167
Muskrat, 104
or Lowland Rabbit, 122
Otter, 162
Red Fox, 145
Skunk, 163
Woodchuck, 63
Sowerby's Whale, 17
spelæum, Osmotherium, 230
speothen, Arvicola, 244
Microtus, 244
Sperm Whale, 14
" Pigmy, 15
Spermophile, Franklin's, 221
Spermophilus franklini, 222
sphenodon, Megolonyx, 249
Spotted Dolphin, 19
Squalodon atlanticus, 247
Biserrate, 247
Squirrels, 5, 52, 225, 242
Squirrel, Carolina Gray, 52, 242
Ground, 221
Northeastern Fox, 58
Northern Gray or Black, 52
Pine, 56
Red, 57
Striped or Ground, 61
Virginia Flying, 66
Western Fox, 57, 225
Star-nosed Mole, 206
Stenorhynchus vetus, 233
stonei, Synaptomys cooperi, 106
striatus, Sciurus, 61
Tamias, 61, 242
subflavus, Pipistrellus, 210, 211
obscurus, Pipistrellus, 211
Vespertilio, 210
subulatus, Myotis, 208, 227
Vespertilio, 208, 227

Sus scrofa, 217
Swamp Mole, 206
Swine, 217
Sword Dolphin, Harlan's, 247
" Ixacanth, 248
" Lacertine, 247
" Porcate, 248
" Urean, 247
Sycium cloacinum, 244
Vole, Cope's, 244
sylvaticus mearnsi, Lepus, 122
transitionalis, Lepus, 121
Synaptomys, genus, 106
cooperi, 106
" stonei, 106

T.

Talpidæ, 198, 227
talpoides, Sorex, 195
Tamias striatus, 61, 242
" lysteri, 61
Tapir, 5, 6, 236
Hay's Fossil, 236
Marsh's Fossil, 236
Tapiravus validus, 236
Tapiridæ, 236
Tapirus americanus fossilis, 236
haysii, 236
tarandus, Cervus, 241
taurus, Bos, 217
Taxidea americana, 231
taxus, 231
Tayassuidæ, 238
Teleopternus orientalis, 240
tetradelta, Arvicola, 244
tetragonus, Mylohyus, 238
Thinohyus antiquus, 238
Tiger, N. Amer. Sabre-tooth, 231
Mercer's Sabre-tooth, 232
Tillodontia, 233
Tillotheridæ, 233
Timber Wolf, 148
Toothed or Sperm Whales, 14
tortulus, Megalonyx, 249
transitionalis, Lepus floridanus, 121
" sylvaticus, 121
Tree Bat, 213
Trichechidæ, 246
Trichecus sp., 246
virginianus, 233
Trilophodon ohioticus, 234
tursio, Delphinus, 17
Tursiops tursio, 17

U.

Ungulata, 5, 24, 234
Uncia inexpectata, 232
mercerii, 232
Urean Sword Dolphin, 247
uraeus, Priscodelphinus, 247
Tretophys, 247
Urocyon, genus, 143
cinereoargenteus, 143, 229
Ursidæ, 183, 228
Ursus, genus, 183
americanus, 183, 228
haplodon, 228
lotor, 182
luscus, 164
taxus, 231

V.

validus, Lophiodon, 236
Tapiravus, 236
velox, Zarachis, 248
Vespertilio borealis, 213
cinereus, 214
fuscus, 212, 227
humeralis, 215
lucifugus, 207
noctivagans, 210
subflavus, 210
subulatus, 208, 227
Vespertilionidæ, 207, 227
vetus, Catodon, 248
Ogmorhinus, 233
Physeter, 248
Platigonus, 239
Stenorhynchus, 233
Virginia Deer, 24, 241
" Northern, 26
Flying Squirrel, 66
Harvest Mouse, 225
virginianus, Cariacus, 241
Cervus, 241
Lepus, 118
" americanus, 118
Rosmarus, 233
Trichechus, 233
Vulpes, 229

vison, Mustela, 167
Putorius, 167
lutreocephalus, Putorius, 167
vitulina, Phoca, 123
volans, Mus, 67
Sciuropterus, 66, 67
Vole, Cope's Sycium, 244
Diluvian, 244
Fossil Pine, 245
Great Anaptogon, 244
Involute Fossil, 245
Lemming, 7
New Jersey, 94
Northern Pine Woods, 101
Pennsylvania Meadow, 97
Wilson's Meadow, 244
Wood, 7, 92
" Gapper's, 92
Vulpes, genus, 145
cinereoargentatus, 229
cinereoargenteus, 229
fulvus, 145
latidentatus, 229
virginianus, 229
vulpes, 221

W.

Walrus, 5, 6, 233
Fossil Atlantic, 233
Wapiti, 241
Eastern, 29
Weasel, 4, 7, 156, 229, 231
Alleghenian Least, 173
Bonaparte's, Lesser or Short-tailed, 168
Great Fossil, 231
New York or Common, 170, 229
Western Fox-Squirrel, 57
Whales, 4, 5, 8, 247
Whale, Baleen, 10
Black Right, 10
Bottle-nosed or Beaked, 16
Cuvier's Beaked, 16
Whale, Great Blue, 13
Leidy's Sperm, 248
Little-piked, 11
New England Humpback, 14
Pigmy Sperm, 15
Pilot, 21
Pug-Head, 16
Right, 10
Slender Zarachian, 248
Sowerby's Cowfish, 17
Sperm or Toothed, 14
Whalebone, 10, 12
Whaling, 5
wheatleyi, Megalonyx, 249
Wheatley's Ground Sloth, 249
White-Bellied Killer, 23
White Rabbit, 118
Wild Cats, 4, 141
Wolf, 5, 143, 223, 228
Gray or Timber, 148, 223, 228
Wolverine, 2, 6, 164, 229
Wood Vole, Gapper's, 92
" New Jersey, 94
Woodchuck, Northeastern, 66
Southeastern, 63, 243
Woodland Caribou, 241

Z.

Zapus, genus, 109, 245
Barton's, 119
Eastern Meadow, 245
Hudson Bay, 109
hudsonius, 109, 245
" americanus, 110
insignis, 113
Zarachian Whale, Slender, 248
Zarachis velox, 248
Zibethicus Castor, 104
Fiber, 104, 245
Ziphiidæ. 16
Ziphius, genus, 16
cavirostris, 16

Los Angeles
This book is DUE on the last date stamped below.

Form L9–10*m*-3,'48(A7920)444

UC SOUTHERN REGIONAL LIBRARY FA
D 000 680 561